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EVALUATION OF THE GEORGIA WATER SUPPLY PROGRAM

Environmental Protection Agency
Atlanta, Georgia

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EVALUATION

# of the

GEORGIA WATER SUPPLY PROGRAM

WATER SUPPLY BRANCH
WATER PROGRAMS OFFICE
AIR AND WATER DIVISION
ENVIRONMENTAL PROTECTION AGENCY

REGION IV
JULY 1973

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PREFACE

This report presents the Environmental Protection Agency's findings, conclusions, and recommendations with supporting data and explanatory text resulting from an evaluation of the Georgia Water Supply Program.

The information contained herein is presented in condensed form and the significance is further discussed in a companion report EVALUATION OF THE GEORGIA WATER SUPPLY PROGRAM - SUMMARY. The SUMMARY highlights important findings and principal needs for those who have an interest in Georgia's drinking water but do not wish to study the details of the complete report.

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SUMMARY OF FINDINGS AND CONCLUSIONS

The health of over 4.5 million people in Georgia is directly dependent upon the condition of their drinking water. Recognizing this, Mr. R. S. Howard, Jr., Director, Environmental Protection Division, Georgia Department of Natural Resources, requested that the Environmental Protection Agency evaluate the Department's Water Supply Program. This report presents the Environmental Protection Agency's findings, conclusions, and recommendations, with supporting data and explanatory text of that evaluation.

Approximately 3.2 million people in Georgia are served by an estimated 1,976 public water supply systems of Class I or Class II status, which are generally termed "public" supplies in this report. There are also an estimated 4,200 Class III systems serving such establishments as restaurants, service stations, recreational facilities, subdivisions, and small trailer courts, and as many as 29 million residents and travelers may be exposed to this water one or more times during a year. At least one-million rural residents obtain drinking water from individual water systems.

The effectiveness of the Georgia Water Supply Program was judged primarily on the bases of drinking water quality, adequacy and condition of water system facilities, and water supply surveillance found in a field evaluation of actual supplies. Twenty (20) public and 81 Class III supplies, representing a cross-section of water supply practice in Georgia, were selected for study. These systems serve approximately

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1,000,000 persons or about 22 percent of the State's population. Rural, individual systems were beyond the scope of this evaluation.

WATER SUPPLY STATUS

report

The following summary presents the findings of this study and documents widespread departures from acceptable standards of waterworks practice in Georgia.

Water Quality-Bacteriological

Thirty-five (35) percent of the public water systems examined did not meet bacteriological standards one or more months in 1972. These systems serve approximately 9,590 people. Insufficient data existed to adequately determine bacteriological quality of an additional 25 percent of the public water systems.

Twelve (12) percent of the Class III systems examined failed to meet bacteriological standards. It is estimated that as many as 19,000 people (State residents and the traveling public) may be exposed to this water during one year's time.

Water Quality-Chemical

All public water systems examined met mandatory chemical drinking water standards.

Seven (7) percent of the Class III water systems failed to meet the mandatory chemical drinking water standards. These six unsatisfactory analyses have not been confirmed, however, and this finding should be considered tentative.

One of the 20 public water systems examined did not meet one or more of the recommended chemical drinking water standards. This system serves approximately 160 people with less than desirable or aesthetically inferior drinking water from a chemical standpoint.

Thirty-three (33) percent of the Class III systems failed to meet one or more recommended chemical standards. As many as 222,000 people (State residents and the traveling public) may be exposed to this water each year.

All 12 fluoridated systems studied needed improvement in at least one aspect of their fluoridation program. Seventeen (17) percent of these systems were fluoridating at less than the proper level, significantly reducing dental health benefits of this treatment. Samples from one system were both above and below the recommended range.

Facilities

Seventy (70) percent of the public water systems had deficient treatment facilities and 55 percent needed important changes in the operation of present facilities. Without these additions and changes, continuous production of safe drinking water may not be maintained.

Only 11 percent of the Class III supplies examined had automatic chlorination equipment.

Forty-seven (47) percent of the public supplies and 5 of 9 Class III supplies which had chlorination equipment did not provide a detectable chlorine residual in all parts of the distribution system. Unsatisfactory chlorination practice reduces the margin of safety against disease transmission through drinking water.

Fifty (50) percent of the public water systems examined had inadequate distribution system storage.

Ninety (90) percent of the public supplies examined had inadequate cross-connection control programs. Flawless treatment avails nothing if the distribution system does not deliver adequate water for essential health needs or permits entrance of hazardous substances through cross-connections or other system deficiencies.

Ninety-four (94) percent of the Class III systems rated overall less than "satisfactory". Seventeen (17) percent had visible sanitary defects, which clearly present the potential for dangerous contamination.

Operator Competence

Seventy-five (75) percent of the public water supplies examined were maintaining inadequate operational records and/or conducting inadequate water quality testing.

Forty-five (45) percent of the public water systems evaluated had only part-time operators and 50 percent of public water supply operators were not certified by the State Board of Examiners. Most of these systems also had water quality problems and/or facilities deficiencies.

Surveillance

Fifty-five (55) percent of the public water systems studied did not meet bacteriological surveillance standards.

Although 85 percent of public water systems received a chemical evaluation during the past three years, most evaluations included few of the 26 constituents listed in the Drinking Water Standards.

Fifty (50) percent of the public supplies had not been inspected by a representative of the Georgia Department of Natural Resources during the previous twelve months. Without public agency surveillance, hazardous conditions will persist undetected and uncorrected.

Twenty-seven (27) percent of the Class III water systems studied had not had a health agency visit in the previous two years. Even when made, these visits often do not include a full inspection of facilities and operational practices.

WATER SUPPLY PROGRAM

This study has documented that staff limitations and unresponsive administrative procedures have prevented the Georgia Water Supply Program from fulfilling its responsibilities to those who drink water in the State. Important Water Supply Program activities are not being performed in a timely and thorough manner or are not being performed at all. Although staff for a fully satisfactory program has never been available, the Water Supply Program as currently operated does not adequately protect public health and may foster a false sense of security.

The number of public water supplies and the population served by these supplies has rapidly increased during recent years. However, the Water Supply Program has not kept pace with this increase either with regard to staff and resources or with regard to administrative policy and procedures. Although budgetary support has increased, a large amount of the increase was absorbed by inflation of salaries and operational costs. Including the cost of laboratory support, about 8.6 cents per person served by public water supply was spent in FY 1973 at the State level to protect public drinking water. Even so, the Georgia Water Supply Program has many deficiencies and many public water systems throughout the State present a health risk to the public. Expanded funding and program redirection and revitalization are both essential to enable the Georgia Water Supply Program to attain full effectiveness and to meet its responsibilities.

Engineering review of bacteriological surveillance data has not been consistent. In many instances, no action toward correction of potentially dangerous water quality could be documented, and actions which could be documented were seldom prompt. Even eliminating all avoidable delays, the present bacteriological surveillance program responds too slowly for satisfactory protection of public health.

Policy of the Georgia State Board of Health prevented the Water Supply Program from pursuing legal compliance procedures prior to its transfer into the Department of Natural Resources. This continuous lack of action by the Water Supply Program seriously compromised its credibility. Recent actions taken by the Department of Natural Resources, however, indicate willingness to make appropriate use of expanded legal procedures. Use of legal procedures to bring unsafe water systems into compliance is crucial to an effective overall program, and expanded use of such procedures is strongly supported.

Current Rules and Regulations for Water Supply Quality Control became effective October 4, 1970, and provide many useful tools for operation of an effective water supply program. Bacteriological finished water quality standards are included, and are patterned after the 1962 PHS Drinking Water Standards. However, important provisions of the Standards have been eliminated or modified.

Statutory and regulatory authority are available for an effective water system certification program. However, policies employed in implementation of the program and lack of sufficient engineering staff have prevented the program from reaching its potential effectiveness. The certification program's present operation appears to give Environmental Protection Division sanction to inadequate and potentially dangerous water supplies, and over 90 percent of the Provisional Certificates of Approval are invalid.

Bacteriology and chemistry laboratories are essential to proper functioning of the Water Supply Program. Analytical procedures used by the bacteriology laboratory were generally in accordance with Standard Methods. However, fully satisfactory laboratory service is limited by a 5-day work week and dependence upon mail return of resterilized sample bottles. Chemistry laboratory service includes few analyses for constituents of health significance.

An immense quantity of laboratory data needs timely, thorough analysis. Late or absent data also needs to be recognized. Automatic data processing techniques offer many advantages for this type task.

The 1973 legislation provided needed improvements in legal tools available for enforcement of water supply rules and regulations. Broad authority is conveyed by the Statute for operation of comprehensive Water Supply Program. No authority is directly given, however, for licensing or regulation of the well drilling industry in the State or for controlling the proliferation of small public water supply systems.

Fluoridation of public water supplies in incorporated communities was made mandatory by the 1973 legislature, and funds for initial fluoridation expense were made available. A community may remove themselves from the terms of this act by referendum.

Operator training activities have reached a large number of public water supply operators. Nevertheless, widespread facility, operational, and quality deficiencies indicate that recommended waterworks practices and public health protection are not being universally applied.

In summary, the Georgia Water Supply Program is not providing the health evaluation and engineering services necessary to fulfill its responsibilities to protect the health of those who drink water in Georgia. To properly provide such services, the following recommendations are made.

RECOMMENDATIONS

It is recommended that:

1. Bacteriological surveillance of public water systems be immediately upgraded through the following:
    - a. Sufficient bacteriological analyses of all public supplies to meet minimum levels specified in State Regulations and Federal Drinking Water Standards, either performed in State laboratories or laboratories certified by the State;
    - b. Strengthening of quality standards included in Water Supply Program Regulations;
    - c. Consistent determinations of compliance with applicable quality standards;
    - d. Administrative procedures to assure timely response to unsatisfactory water quality and early detection of supplies which have not submitted samples;
    - e. Extended laboratory services; and
    - f. Institution of automatic data processing techniques for storage and analysis of bacteriological data.

2. The Water Supply Program increase and improve engineering surveillance of all public drinking water supplies to at least minimum levels. This should include, but not necessarily be limited to:
    a. Thorough periodic sanitary surveys of each system, setting priorities and schedules for improvements;
    b. Timely, thorough review of monthly operating reports, bacteriological records, and chemical surveillance data;
    c. Complete routine chemical analyses of all supplies; and
    d. Engineering review of all plans for new systems with sufficient field inspection to assure construction in accordance with approved plans.

3. Policies employed in the water system certification program be revised to eliminate present Departmental sanction of seriously deficient water systems and to revitalize the certification program as an effective tool for obtaining compliance with applicable Rules and Regulations.

4. Encouragement and cooperation continue to be emphasized to obtain compliance with Departmental Rules and Regulations. However, if these measures fail, continued and expanded use

of legally enforceable compliance order procedures should be undertaken.

5. A working agreement with the Department of Human Resources be completed which would designate County Health Departments as responsible for surveillance of Class III (small) public water systems. Requirements for increased bacteriological surveillance, mandatory disinfection, and construction standards are needed.

6. A single document be developed and distributed which incorporates program policy and design standards for public water systems.

In order to fully implement the above, it is recommended that:

7. Professional staff of the Water Supply Section be increased from seven professionals and two secretaries to at least 31 professionals and 8 secretaries by the end of FY 76. Budgetary support should be increased from about $139,000 to approximately $678,000 during this period.

8. Bacteriological laboratory support for the Water Supply Program be increased through addition of one bacteriologist and one clerk for the Atlanta laboratory and initial staffing of branch laboratories in Brunswick and Albany with at least one bacteriologist and one technician.

Increases in annual budget of approximately $110,000 are needed for minimum services, with capability to support a fully satisfactory program costing as much as $495,000 annually.

9. Chemistry laboratory support for the Water Supply Program be increased through addition of three chemists and one clerk over three years. Additional space and equipment are also recommended. Approximately $95,000 should be expended annually for full drinking water chemistry laboratory support.

10. Water Supply Program activities be decentralized by initial assignment of two professionals each to regional offices planned for Brunswick, Macon, and Albany as soon as competent staff can be recruited and trained.

11. The Water Supply Program prepare a comprehensive inventory of public water supplies including pertinent information such as source, treatment, population served, ownership, and status in State Certification Program. Means should be provided for periodic updating.

INTRODUCTION

This evaluation was conducted to determine the effectiveness of the Georgia Water Supply Program, and to recommend such improvements as may be needed to assure safe, wholesome drinking water for the residents of Georgia.

The study was undertaken by the Water Supply Section, Environmental Protection Agency at the request of Mr. R. S. Howard, Jr., Director, Environmental Protection Division, Georgia Department of Natural Resources.

BACKGROUND

In 1910 the Georgia State Board of Health established a laboratory for the chemical and bacterial examination of drinking water. With increased recognition of water supply surveillance as a legitimate function of the Health Department, the Sanitary Engineering Division was established in 1920. Field studies of water supply systems were conducted and the bacteriology laboratory was expanded. The number of people served by public water supplies increased in the ensuing years, and the Water Supply Program gradually increased its staff and activity. Water pollution control activity within the Water Supply Program increased in the late 1950's and early 1960's, and in 1964 the water pollution control activity was moved to a newly established agency. Although no staff was lost at this time, the Water Supply Program has not subsequently grown as have the number, size, and complexity of water supply systems. The program was removed from the Health Department in June 1972 and joined other environmental programs in the Department of Natural Resources.

PURPOSE OF EVALUATION

Specifically, this evaluation attempted to:

1. Ascertain the present condition of public water supply operations in Georgia, especially conditions relating to safety and reliability of the supplies.

2. Determine the adequacy of the Department of Natural Resources Water Supply Program's legal statutes, budget, manpower resources, regulations and policies, laboratory support, surveillance, and operator training.

3. Review the effectiveness of the Water Supply Program in light of the present conditions of the State's water supplies, and make recommendations as to what additions and revisions should be made to assure adequate health protection for those drinking water in Georgia.

SCOPE

WATER SUPPLIES IN GEORGIA

According to the 1970 census, 4,589,575 people reside in Georgia. About 3,200,000 of these people are served by an estimated 1,976 public water supplies of Class I or Class II status, which are included in the State Water Supply Program. In addition to these, as many as 29,000,000 persons may drink water each year supplied by an estimated 4,200 Class III water systems serving residents and travelers at restaurants, service stations, recreational facilities, trailer courts, small subdivisions and other similar establishments.

Departmental Rules and Regulations broadly define public and community water systems to include all supplies serving the public or serving more than one family. The regulations further classify public and community systems into Class I, Class II, and Class III as follows:

Class I	Water Supply Systems supplying finished water from any surface water sources.
Class II	Water Supply Systems supplying finished water from ground water sources to more than twenty-five (25) housing units or mobile home units, to schools, to State owned facilities, and to industrial operations employing more than one hundred (100) persons.
Class III	All other water supply systems supplying finished water from ground water sources, including but not limited to, tourist accommodations, food service establishments, and commercial establishments.

Class I and Class II systems are generally referred to as "public" in this report, although ownership may be private.

It is also estimated that over one million rural Georgia residents use individual home systems for domestic water needs. These systems are excluded from the jurisdiction of the Water Supply Program, and are beyond the scope of this Evaluation.

WATER SUPPLIES STUDIED

Through correspondence with Mr. R. S. Howard, Jr., and discussions with Mr. Leonard Ledbetter and Mr. Robert Byers of the Environmental Protection Division, it was agreed that the study would generally follow the procedures used in the state program evaluations completed previously in Tennessee and Kentucky.

It was agreed that investigation of a representative number of water supplies was sufficient to judge the effectiveness of the Georgia Water Supply Program. A sample of all types of public water supplies was selected for study. The technique used for selection of the study sample was not intended to provide a perfect random sample. However, the results are considered to reasonably represent water supply practice in the State.

Twenty (20) Class I and Class II public water supplies were selected to include a wide range of size, types of source, methods of treatment, and geographical location within the State. These 20 supplies provide a cross section of water supply practice by systems under the surveillance of the State Water Supply Program. It is estimated that these systems serve approximately 1,000,000 people or about 31 percent of those served by public water supplies in Georgia. Four (4) of the systems provide drinking water to commercial carriers operating interstate. The number of interstate travelers so served is unknown. A list of the systems surveyed is tabulated in Appendix A and their location is shown in Figure 1.

Six (6) of the 20 supplies selected for study adjust the fluoride content of their water for dental health protection. A special fluoride study was made of these and six other systems, which were selected to provide a representative sample of fluoridation practice in the State.

Three (3) counties were selected for study of all Class III public water supplies located within them. Supplies of this type are small and numerous, serving establishments such as trailer parks, subdivisions, restaurants, and recreational facilities. The three counties selected were Cook in the south, Jones in the central, and Forsyth in the northern part of the State. Eighty-one (81) Class III systems were surveyed, and it is estimated that as many as 29 million[1] Georgia residents and travelers may drink water from this type of supply at some time during the course of a year. Seventeen (17) Forsyth County Class III supplies are operated by the U.S. Army Corps of Engineers and are not officially under the authority of the State Water Supply Program.

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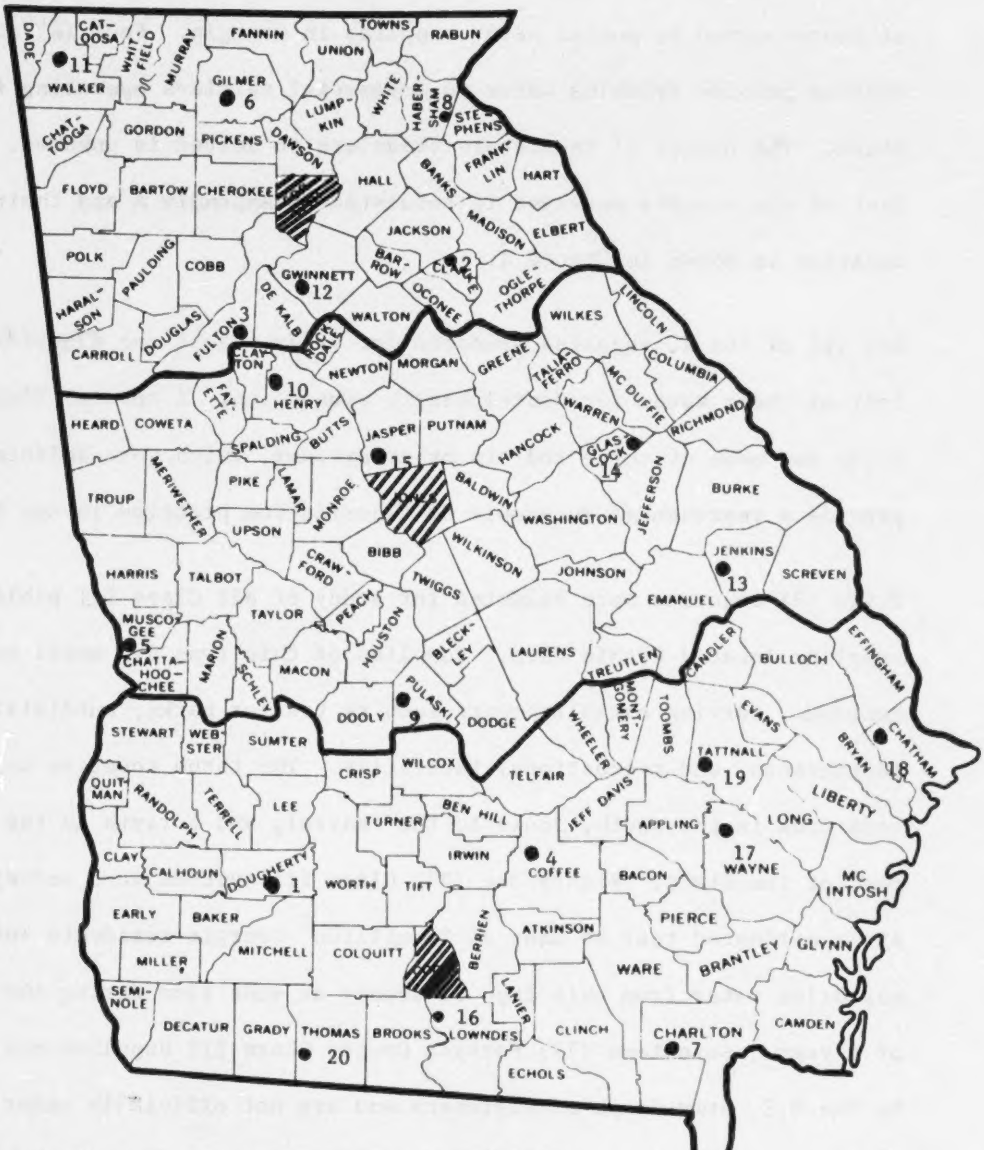
[1] The bases for these estimates may be found in Appendix B

Figure I

Water Supply Systems Selected For Study


DADE
CAT-OOSA
WHITFIELD
MURRAY
FANNIN
TOWNS
UNION
RABUN
11
WALKER
GILMER
6
LUMPKIN
WHITE
HABERSHAM
8
STEPHENS
CHATTOOGA
GORDON
PICKENS
DAWSON
FRANKLIN
HART
FLOYD
BARTOW
CHEROKEE
HALL
BANKS
MADISON
JACKSON
ELBERT
POLK
PAULDING
COBB
GWINNETT
BARROW
CLARKE
2
OGLETHORPE
12
HARALSON
DE KALB
WALTON
OCONEE
WILKES
LINCOLN
FULTON
3
DOUGLAS
CARROLL
CLAYTON
ROCKDALE
NEWTON
MORGAN
GREENE
TALIAFERRO
COLUMBIA
MC DUFFIE
10
FAYETTE
HENRY
WARREN
RICHMOND
HEARD
COWETA
BUTTS
JASPER
PUTNAM
HANCOCK
GLASCOCK
14
SPALDING
15
TROUP
MERIWETHER
PIKE
LAMAR
MONROE
JONES
BALDWIN
JEFFERSON
BURKE
UPSON
WASHINGTON
BIBB
WILKINSON
JENKINS
HARRIS
TALBOT
CRAWFORD
TWIGGS
JOHNSON
13
SCREVEN
EMANUEL
TAYLOR
PEACH
HOUSTON
MUSCOGEE
5
CHATTAHOOCHEE
MARION
SCHLEY
MACON
BLECKLEY
LAURENS
TREUTLEN
CANDLER
BULLOCH
EFFINGHAM
PULASKI
9
MONTGOMERY
TOOMBS
EVANS
STEWART
WEBSTER
SUMTER
DOOLY
DODGE
WHEELER
TATTNALL
CHATHAM
BRYAN
18
QUITMAN
RANDOLPH
TERRELL
CRISP
WILCOX
TELFAIR
19
LEE
TURNER
BEN HILL
JEFF DAVIS
APPLING
LIBERTY
LONG
CLAY
CALHOUN
DOUGHERTY
1
WORTH
IRWIN
4
COFFEE
17
WAYNE
TIFT
BACON
MC INTOSH
EARLY
BAKER
BERRIEN
ATKINSON
PIERCE
MILLER
MITCHELL
COLQUITT
WARE
BRANTLEY
GLYNN
SEMINOLE
LANIER
16
DECATUR
GRADY
THOMAS
BROOKS
LOWNDES
CLINCH
CHARLTON
7
CAMDEN
20
ECHOLS

▨ Counties Selected for Class III Water Supply Evaluation

● Public Water Supplies Evaluated

North Ga.

11-Kennsington Water Authority
6-Ellijay
8-Habersham Mills
12-Lawrenceville
3-Atlanta
2-Athens

Middle Ga.

10-Henry Co.
15-Monticello
14-Mitchell
13-Midville
9-Hawkinsville
5-Columbus

South Ga.

1-Albany
4-Broxton
19-Reidsville
18-Azalea Park Annex
17-Odum
16-Oak St. SubDivision
20-Thomasville
7-Folkston

PROGRAM EVALUATION

The basic water supply Statute, regulations, and program policies were reviewed. The Water Supply Program's activities, responsiveness to water supply problems, and staffing were also examined. Reported waterborne disease outbreaks were studied. Additionally, waterworks personnel, municipal officials, health officials and others were interviewed.

Two bacteriological laboratories were surveyed and evaluated. These included the Department's Central Laboratory, and one water treatment plant laboratory previously certified by the Department. The Department's Water Chemistry Laboratory and the Water Supply Program's chemical surveillance activity were also studied.

EVALUATION CRITERIA

The effectiveness of the Georgia Water Supply Program was gauged to a large degree on the bases of drinking water quality, adequacy and condition of water system facilities, and water supply surveillance.

WATER QUALITY

Bacteriological quality of public water systems was judged by comparing the bacteriological sampling record compiled during the 12 months of 1972 against the Public Health Service Drinking Water Standards. Any system failing to meet the bacteriological limits one or more of these months was considered to have failed the bacteriological standard. Since the Water Supply Program does not routinely sample all Class III water systems, they were judged on the basis of a single bacteriological sample collected during the field visit and examined by the Department Laboratory. Any sample showing organisms of the coliform group in three or more of five 10 ml portions (MPN of 9.2 or greater) and/or having fecal coliform bacteria was considered to have failed the bacteriological standard.

Chemical quality of public water supplies was judged on the basis of a trace metals sample collected from the water treatment plant during the field inspection. Carbon filter, radiological and pesticide samples were also collected at treatment plants utilizing the Chattahoochee River. These samples were analyzed by Environmental Protection Agency Laboratories. Each sample was compared individually to the Public Health Service Drinking Water Standards and determined as either:

1. Meeting the Standards for all constituents, or
2. Meeting all "mandatory" constituent limits, but failing to meet one or more "recommended" constituent limits (some are aesthetic parameters), or
3. Failing to meet one or more "mandatory" constituent limits, or
4. Failing to meet both recommended and mandatory limits.

FACILITIES

Public water supply source, treatment, operation and quality control were judged on the bases of the Manual for Evaluating Public Drinking Water Supplies and the Drinking Water Standards, employing the same interpretations as were used in the Tennessee and Kentucky Water Supply Program Evaluations.

Source

Quality of the source was judged where possible by chemical analyses, and also by past experience of the treatment plant operator. Quantity was judged by historical experience and current water demands. Source protection was judged by the type of source, potential and/or actual problems, and adequacy of monitoring conducted.

Treatment

Treatment was judged on the bases of the facilities and their operation (as observed on the day of the field visit), bacteriological records and chemical analyses. Effectiveness of disinfection was judged by the presence of a detectable free chlorine residual in all parts of the distribution system.

Distribution System

Finished water storage was judged adequate if elevated or non-pumped storage equaled or exceeded the system's average daily demand. Pumped storage was included only where on-site internal combustion or steam auxiliary powered pumping equipment was available. Raw water storage was also included if auxiliary power was available to provide treatment and pumping. Storage for "distribution only" systems included consideration of storage in the parent system. A distribution system pressure of at least 20 psi in all parts of the system was considered adequate for the purpose of this study. However, a minimum of 25 psi is considered desirable to insure optimum operation of all plumbing fixtures.

Quality Control

Water quality testing was judged by the bacteriological and chemical tests being performed by the water purveyor on finished water. Record keeping practices were judged by records maintained at the water treatment plant or water treatment plant operator's office and available for inspection at the time of the field visit. The cross-connection control program was judged by the existence of an ordinance, program implementation, and progress toward eliminating hazards.

As shown in Tables III and IV, Appendix A, water system quality and surveillance, and system reliability were divided into categories for examination and rating. Each system was then assigned a "Reliability Rating" and a "Quality and Surveillance Rating" ranging from 0 to 10, which reflects the number of deficiencies found. Zero deficiencies ("0" Rating) indicates least or little risk. A rating of 3 or higher was judged to indicate substantial departure from recommended practice, with attendant public health risk.

Class III water systems were judged on the basis of the Manual of Individual Water Supply Systems in addition to the references already cited. The adequacy of these facilities was judged on the basis of a sanitary survey accomplished at the time of the field visit.

SURVEILLANCE

Water supply surveillance was judged on the bases of the Drinking Water Standards and the Manual for Evaluating Public Drinking Water Supplies. Bacteriological surveillance was considered satisfactory if the number of bacteriological samples examined per month during 1972 met the minimum number specified by the Drinking Water Standards. Chemical surveillance was considered satisfactory if a chemical analysis (as distinguished from normal in-plant operational checks) was performed by the State or an independent laboratory within the past three years and there was no record of significant problems. (The supplies were not rated unsatisfactory even though the State's routine analysis included few constituents of health significance.) Engineering surveillance was considered satisfactory if an inspection by Water Supply Section personnel had been made sometime during 1972. More frequent than annual inspections, however, are considered necessary for optimum surveillance.

OTHER CRITERIA

Bacteriological laboratories were judged on the basis of the Public Health Service Manual entitled, Evaluation of Water Laboratories, and Standard Methods for the Examination of Water and Wastewater. Chemical laboratory procedure was also judged by Standard Methods.

The adequacy of operator training was judged by the absence or presence of operational and quality control deficiencies, the operator's certification status, and the operator's awareness of the relationship between drinking water quality and public health.

FINDINGS ON GEORGIA WATER SUPPLIES

WATER QUALITY

The bacteriological quality of Georgia water supplies is reflected by the following:

> Thirty-five (35) percent of the public water systems examined did not meet bacteriological standards one or more of the past 12 months. These systems serve approximately 9,590 people.
>
> Insufficient data existed to adequately determine bacteriological quality of an additional 25 percent of the public water systems.
>
> Twelve (12) percent of the (81) Class III systems examined failed to meet the bacteriological standards and fecal contamination was confirmed in 10 percent of these (81) supplies. It is estimated that as many as 19,000 people (State residents and the traveling public) may be exposed to this water during one year's time.

Failure to meet bacteriological standards indicates a serious, potential health hazard and calls for prompt corrective action. Additional details and supporting data may be found in Appendices A and B.

Chemical analyses of the water systems studied indicated that:

> All public water systems examined met the mandatory chemical standards.

Seven (7) percent of the Class III water systems failed to meet the mandatory chemical drinking water standards. These six unsatisfactory analyses have not yet been confirmed, however, and this finding should be considered tentative.

Drinking water must not contain any impurities which may be toxic or otherwise hazardous to human health. Drinking water failing to meet the mandatory chemical standards poses such a threat.

One of the public water systems examined failed to meet recommended chemical standards. This system serves approximately 160 people.

Thirty-three (33) percent of the Class III water supplies examined failed to meet one or more recommended chemical standards. As many as 222,000 people may be exposed to this water during one year's time.

The recommended chemical standards are intended to assure that no constituent is present in quantities which impart objectionable taste, odor, and/or undesirable physiological effects to drinking water, rendering it less than desirable or aesthetically inferior. Good quality drinking water should contain no impurity which would cause offense to the sense of sight, taste or smell, and should have chemical characteristics considerably better than the limiting values established by the recommended standards. As indicated above, a percentage of the Georgia supplies in each category studied failed to meet these standards. See Appendices A and B for additional details on chemical quality.

FACILITIES

Public Water Supplies

A sanitary survey of the water system facilities of the 20 public water supplies studied revealed that:

(Sources)

Forty-five (45) percent had inadequate source protection.

Fifteen (15) percent of the sources had unsatisfactory raw water quality.

All supplies were judged to have sources of adequate quantity.

(Treatment)

Seventy (70) percent of the systems needed additional treatment facilities.

Fifty-five (55) percent of the systems needed important changes in operation of present treatment facilities.

Forty-seven (47) percent of those systems which have equipment to chlorinate or which purchase and redistribute chlorinated water failed to maintain chlorine residual in all parts of the system.

(Distribution)

Fifty (50) percent of the systems had inadequate distribution storage.

All 20 systems reported adequate water pressures in the distribution system.

(Quality Control)

Seventy-five (75) percent of the systems were not maintaining adequate operational records and/or conducting adequate water quality testing.

Ninety (90) percent of the systems were found to have inadequate cross-connection control programs.

Only one of the public water supply systems was found to meet all system reliability criteria. The remaining 19 public water supplies were found to be deficient in one or more criteria. Many systems had deficiencies in five or more. The average deficiency rating was 4.0 indicating a significant potential hazard to public health. See Appendix A for additional details concerning public water systems.

Class III Public Water Supplies

A sanitary survey of the 81 Class III water supply facilities revealed that:

Only 11 percent had automatic chlorination equipment.

Fourty-four (44) percent of the 9 systems which had chlorination equipment were found to have no chlorine residual in the system.

Seventeen (17) percent were observed to have a visible sanitary defect.

Ninety-four (94) percent received an overall rating less than "satisfactory".

Class III water systems serve a large number of people in Georgia and the deficiencies enumerated above indicate a serious potential public health hazard. See Appendix B for additional details concerning Class III systems.

FLUORIDE PRACTICE

Seventy-four (74) public water supplies in Georgia adjust the fluoride content of their water. These supplies serve an estimated 2.2 million of the approximately 3.2 million people served by public water systems. Approximately 68 percent of all those served by public water supplies in Georgia receive fluoridated drinking water.

A study was made of 12 fluoridated public water systems which serve approximately 852,000 people. The study revealed that:

All 12 fluoridated systems studied needed improvement in at least one aspect of their fluoridation program.

Twenty-five (25) percent of the systems were not fluoridating at the proper level.

Fifty-five (55) percent were deficient in analytical control of fluoridation.

Forty-two (42) percent were deficient in fluoridation equipment and facilities.

Forty-two (42) percent were deficient in storage and handling of fluoride chemicals.

Twenty-seven (27) percent of the operators were not adequately trained in analytical testing equipment and procedures.

Forty-two (42) percent of the operators did not accept or were otherwise not interested in fluoridation.

OPERATOR COMPETENCE

Evaluation of the operators and their qualifications for the 20 public water supplies studied indicated that:

Forty-five (45) percent of the water systems do not have full-time operators.

Fifty (50) percent of the systems had no operator certified by the State Board of Examiners.

One of the chief operators had college level training. Forty-five (45) percent had received their waterworks training at State sponsored short schools. Fifty (50) percent of the operators had no formal waterworks training.

All systems with an operator having no formal waterworks training failed to meet water quality standards and/or had a Facilities Reliability Rating or a Quality and Surveillance Rating of 3 or greater.

All systems with a non-certified operator failed to meet water quality standards and/or had a Facilities Reliability Rating or a Quality and Surveillance Rating of 3 or greater.

Sixty (60) percent of the systems with a short school trained operator failed to meet water quality standards and/or had a Facilities Reliability Rating or a Quality and Surveillance Rating of 3 or greater.

The operation of Class III water systems varies widely with type and size of the establishment served. Often the owner, manager or person-in-charge also acts as water treatment operator. In some cases operation of the water facilities is delegated to maintenance personnel. Few, if any, of the Class III water supply operators have received formal waterworks training.

SURVEILLANCE

Of the 20 public water supply systems studied:

> Fifty-five (55) percent failed to meet bacteriological surveillance standards.
>
> Eighty-five (85) percent had received a chemical evaluation during the past three years. However, the chemical analyses in most cases included few of the 26 constituents listed in the Drinking Water Standards.
>
> Fifty (50) percent of the systems had not been inspected by a representative of the Georgia Department of Natural Resources during the previous 12-month period.

Review of the 81 Class III water systems indicated that:

> Twenty-seven (27) percent had not had a health agency visit in the previous two years. In most cases, a visit consisted of collecting a water sample and did not include a full inspection of facilities and operational practices.

In general, routine surveillance of Class III systems was provided by county sanitarians who are not fully trained in maintenance and operation of water treatment facilities.

Bacteriological and chemical surveillance were considered inadequate for systems serving the public.

GEORGIA WATER SUPPLY PROGRAM

AUTHORITY - PRESENT OPERATION

The Georgia Water Supply Program is administered under authority vested in the State Board of Health under Georgia Laws, Chapter 88-26, and subsequently transferred to the Department of Natural Resources under the Executive Reorganization Act of 1972.

Statute

Section 88-2601 states:

> "...the quality of such waters (public and community water supplies) is a major factor involving the health and welfare of all people in the State of Georgia...the Government of the State shall assume responsibility for the quality of said water, and the establishment and maintenance of a water quality control program adequate for present needs and designed to care for the future needs of the State..."

The entirety of this chapter provides the Department of Natural Resources with broad authority to conduct a program to regulate the design, construction, and operation of public water supplies in Georgia. Individual sections of this chapter authorize the Department to: adopt water quality standards, rules and regulations; issue certificates of approval; conduct inspections and investigations; issue emergency orders with immediate effect; prohibit the operation of unapproved waterworks; enter premises for purposes of inspection of water supply facility; consult with and cooperate with other agencies; and pursue legal remedy for violations through State Attorney General.

The 1973 Georgia Legislature enacted legislation which brought the Water Supply Program legal operating procedures essentially equal to those of the other programs administered by the Environmental Protection

Division. Improvements included provision for: revocation of operating certificates for good cause upon written notice; adoption of Rules and Regulations in accordance with the Georgia Administrative Procedure Act; direct issuance of compliance orders by the Director of the Division of Environmental Protection; administrative hearings and judicial review in accordance with Section 17(a) of the "Executive Reorganization Act of 1972"; use of the Statute or a final order of the Director; and repeal of conflicting laws.

The 1973 legislature amended Section 88.2603 to require "fluoridation of potable public water systems in incorporated communities lying wholly within this State." However, local referendum can remove supplies from the terms of this act. Funds are provided for initial installation costs.

The "Certification of Water and Wastewater Treatment Plant Operators Act" created a State Board of Examiners for Certified Water and Wastewater Treatment Plant Operators. Certification became mandatory after July 1, 1972. Although the Water Supply Section does not directly implement this act, a strong connection exists through the Water Supply Section Chief, who is a member of the Board.

Regulations

The regulations for public water supplies currently in use by the Environmental Protection Division were enacted pursuant to authority vested in the State Board of Health and the latest revision became effective on October 4, 1970. These regulations entirely superceded an earlier document. Regulations pertaining to certification of water treatment plant operators became effective July 1, 1970, and with certification mandatory after July 1, 1972.

The Rules and Regulations for Water Supply Quality Control, Chapter 270-5-15, principally include basic definitions, requirements for preliminary engineering reports and plans and specifications, technical design standards, provision for issuance of Certificates of Approval, finished water quality standards, and bacterial surveillance requirements. These Rules and Regulations were transferred to the Department of Natural Resources under the Executive Reorganization Act of 1972.

"Public or Community Water Supply System" is defined as "any water supply system regardless of ownership or operation, serving or intended to serve water for domestic use or human consumption to the public or any segment thereof, except an individual water supply system serving a single family dwelling." Systems are divided into Class I, II, and III based primarily on size and number of persons served. Certain requirements of the Rules and Regulations differ for systems of each class.

The Regulations, in combination with the Statute, provide a generally comprehensive basis for operation of the Georgia Water Supply Program. Considerable technical detail is included, such that the document should be extremely useful to the Municipal or Consulting Engineer. Many provisions of the Rules and Regulations are quantifiable, giving specific guidance.

Policy

The Water Supply Section's policies have developed as a consequence of various situations which occurred over the years. Much engineering design detail is included in Departmental Regulations. However, additional engineering design, operation, program management, and surveillance requirements have been established and are contained in various memorandums or are simply understood and followed by program staff.

The Ten State Standards are often used by the Water Supply Program, and development of an edited version of this publication is contemplated by the Program. The edited standards would be supplemented with existing policy and officially published by the Department.

AUTHORITY - PROGRAM NEEDS

The applicable statutes and the Rules and Regulations provide a generally strong and comprehensive foundation for the Georgia Water Supply Program. These documents are considered to be among the strongest features of the program. Nevertheless, certain features are absent which would further strengthen the bases for administration of an effective water supply program.

Statute

The 1973 legislation appears to have provided needed improvements and change which will have a definite beneficial influence on the program.

The authorization allowing the Director to issue compliance orders, and the use of civil penalties for non-compliance are particularly important. Enforcement procedures, as provided by the former law, were cumbersome and unresponsive, and were not used.

The Statute refers to "public and community water supplies" but does not provide a definition. A definition is included in the Rules and Regulations, however, which includes all water supply systems in the State except those serving an individual family. Only "private" supplies are excluded from the definition; hence all but private supplies are subject to Departmental regulation.

The Statute does not authorize or direct the Water Supply Program to assure comprehensive, orderly development and expansion of public water supplies. Planning for best use of water and land resources is needed. Authorization should be provided in the Statute for the Water Supply Program to exert control over the proliferation of small water systems and to promote regional systems where practical.

Groundwater sources are used for over 90 percent of all public water supplies in Georgia, and groundwater is also used for a wide variety of other private and commercial uses. A Groundwater Use Act passed in 1972 and revised in 1973 provided the Environmental Protection Division limited regulatory authority over groundwater use. However, at this writing no State program has effective means to license or otherwise regulate the well drilling industry and protect the sanitary quality of groundwater resources.

Regulations

The Rules and Regulations for Water Supply Quality Control, Chapter 270-5-15, contain many of the features the Environmental Protection Agency considers essential to a document of this type. The Department of Public Health of Georgia is designated to administer and enforce these Rules and Regulations. The Executive Reorganization Act of 1972 transferred authority to administer and enforce these Rules and Regulations to the Department of Natural Resources, Environmental Protection Division. Proposed beneficial changes and additions to the Rules and Regulations are indicate below.

The Regulations properly require the submission of an Engineering Report during the planning stages of public or community water supply systems. Section 270-5-15-.06 describes the features of this Engineering Report. The language of the section, however, does not include specific reference to comprehensive county or regional water supply planning. The proliferation of small and/or poorly designed, uncoordinated water systems has presented a burden to State regulatory agencies and these systems have often been found to fail minimum State standards for health and safety. The Regulations should refer to the need for coordinating planning of a new water system with more comprehensive water resources or regional planning.

An entire section of the Regulations is devoted to source of water supply, and data is required to be submitted to the Department concerning quality, quantity, and protection of a proposed source. No specific raw water standards are included, however, and no reference is made to the applicable water quality criteria of the State Water Quality Board.

The Rules and Regulations specify that monthly bacteriological samples shall be submitted to the State for analysis. It is also required that all surface water source systems and all groundwater systems serving 10,000 or more persons be equipped with a bacteriological laboratory and perform additional bacteriological analyses. The number of such additional analyses depends on population served. Tests are to be performed in a laboratory approved by the Department using procedures established in the latest edition of Standard Methods for the Examination of Water and Wastewater, or as such tests may be modified by the Department. It is recommended that these provisions be strengthened by inserting a requirement into Section 270-5-15-.15(7) that all bacteriological laboratories be certified by the Department. It is further recommended that the provision be eliminated which grants the Department authority to approve nonstandard methods.

Rules and Regulations specify that all water plants shall have equipment to perform all laboratory tests pertinent to control of the plant operation. Types of tests needed for each type of plant, however, are not specified. It is recommended that minimum tests for operational control be specified for the various levels of treatment.

The bacteriological quality standards of the Rules and Regulations are patterned after the 1962 PHS Drinking Water Standards. Important provisions of the Standards, however, have been eliminated or modified. In the text of the standards applicable to membrane filter technique results, the Rules and Regulations have omitted the portion which specifies that coliform colonies per standard sample shall not exceed 3/50 ml, 4/100 ml, 7/200 ml, or 13/500 ml in: (a) two consecutive samples; (b) more than one standard sample when less than 20 are examined per month; or (c) more than five percent of the standard samples when 20 or more are examined per month. This provision is considered essential to the standards and its inclusion is strongly recommended. Similarly, the provision of the standards requiring prompt daily resampling from a location where a standard sample shows unsatisfactory quality has been modified and weakened.

Cross-connections are not defined in the Rules and Regulations and no provisions are directly applicable to requiring a water supply system to conduct a program of cross-connection control. Effective cross-connection control regulations should be included, the thrust of which should be to require and support cross-connection programs at the local utility level.

Consideration should be given to incorporation of bacteriological and chemical quality standards for bottled water. Frequency and type of testing should also be specified.

Policy

The Water Supply Section has adopted many policies which together with the Statute and Regulations, provide the basis for operation of the program. It is unfortunate, however, that policy documents have not been written and assembled in a form suitable for general distribution. It is recommended that development of a comprehensive policy and design criteria document be prepared. Such a document would be useful for consulting engineers and others preparing water system plans, and would be extremely valuable for orientation and use of new Water Supply Program employees, especially those located in field offices.

ACTIVITIES-PRESENT OPERATION

Engineering

Priorities

Planning documents developed by the Water Supply Section prior to its transfer to the Department of Natural Resources itemized a number of activities that are or should be routinely performed. These activities include:

1. Engineering review and approval of construction plans.
2. Consultation with engineers, owners, or operators of public water supplies.
3. Establishment of design criteria.
4. Inspection of construction for compliance with approval plans.
5. Issuance of certificates of approval to satisfactory water systems.
6. Performance of routine water system inspections.
7. Review of laboratory data and monthly operating reports.
8. Investigation of problems and emergencies.
9. Training of water system operators.
10. Issuance of certificates of potability for food, egg, and poultry plants.

The Water Supply Program has further established priorities for performance of these activities when workload as compared to staff availability forces choices to be made. Highest priority is given to responding to water quality constituting a public health hazard. Second priority is placed on review and approval of engineering construction plans, with associated consultations and/or inspections. Third priority is given performance of routine engineering inspections of operating water supplies. This priority is further broken down such that routine inspections are emphasized for Class I supplies.

A policy has been established to perform engineering inspections of all Class I supplies at least twice per year and all Class II supplies at least once per year. Staff limitations and other work have never allowed this goal to be attained.

Certificates of Approval

Persuant to authority granted in the 1964 Statute, Rules and Regulations specify that all persons operating public or community water supply systems shall make application for a Certificate of Approval. Systems which comply with all provisions of the Rules and Regulations are awarded Certificates of Approval by the Environmental Protection Division. A supply not initially in compliance will be issued a Provisional Certificate of Approval. The Provisional Certificate will remain in effect until the application is approved or disapproved, not to exceed one year from the filing date of the application.

As of December 31, 1972, the Water Supply Section prepared a summary reporting the certification program status of 465 publicly owned Class I and Class II water supplies which use their own source of raw water.

The following facts were reported:

1. 74 have been issued final Certificates of Approval;
2. 149 have valid Provisional Certificates of Approval;
3. 197 have Provisional Certificates issued more than one year ago, and therefore invalid;
4. The remaining 45 supplies have not been issued a certificate of any kind.

At this writing, it is estimated that 90 percent or more of the Provisional Certificates are in excess of one year old. The Water Supply Program has attempted to bring all Class I and Class II supplies under the certification program. No attempt has been made to receive applications from Class III supplies.

The Environmental Protection Agency field evaluation of 20 water supply systems revealed significant findings regarding the condition of the supplies and the State certification program. Of the 20 systems evaluated, 5 had final Certificates of Approval. Based on information obtained by the Environmental Protection Agency during the field evaluation, all 5 of these systems had a Quality and Surveillance Rating less than 3 and four had a Facilities Reliability Rating less than 3. Ratings lower than 3 indicate substantial compliance with high standards of waterworks practice. Of the 13 supplies holding Provisional Certificates of Approval, all but 4 had a Quality and Surveillance Rating of 3 or higher and all but one had a Facilities Reliability Rating of 3 or higher. A rating of 3 or higher raises serious questions regarding the supply's ability to continuously deliver acceptable drinking water.

Plan Review

Review of an estimated 400 plans and specifications annually by the Water Supply Section requires approximately 2½ man-years. This review activity is required by Regulation and in many cases involves detailed calculations, consultations, and occasionally field visits. Increased attention has been placed upon this activity in the past year in response to widely publicized incidents where community systems proved unable to supply adequate quantities of water. Emphasis on this activity, however, has necessitated sacrifice of other important activities. The appropriate follow-through for the plan review activity, supervision and inspection of the resultant construction activity, is only performed to a limited degree.

Monthly Operational Reports

Monthly operational reports submitted by the supplies and bacteriological data are constantly being sent to the Water Supply Section by the Laboratory Section for review and evaluation. Manpower shortages have limited detailed, timely attention to this important activity.

Training

Formal training activities of the Water Supply Section take the form of two courses annually presented in a cooperative effort with the Georgia Water and Pollution Control Association. One four-day course is conducted in north Georgia each spring which is directed to operators of surface water treatment plants. The other course is presented three days in the fall and is directed toward operators of ground water supplies. Approximately 200 to 300 water plant operators are trained each year in these courses. At the close of each course, the State Board of Examiners for Certified Water and Wastewater Treatment Plant Operators administers an examination for certification of water treatment plant operators under the State's mandatory operator certification program.

In 1972, 266 operators received training and 200 took an examination for certification. One-hundred sixty-two (162) operators, or 81 percent, passed the examination. Emphasis in both training and operator certification has been upon operators of municipal systems, with operators of Class II private supplies receiving little attention. For this reason, a large proportion of Georgia water system operators are untrained and uncertified.

The operator training activity and mandatory operator certification mainly impacts the larger water systems in the State. Of the 20 systems inspected for this evaluation, only 10 were operated by certified men. In addition, the findings show that many of the systems operated by certified personnel have significant deficiencies. Six (6) of the 10 systems operated by a certified operator had a Facilities Reliability Rating of 3 or higher and three systems had a Quality and Surveillance Rating of 3 or higher, with the higher rating indicating greater risk.

Nevertheless, trained operators appeared to perform somewhat better than those not trained. Ratings of supplies operated by uncertified men averaged significantly poorer than those operated by certified operators.

Laboratory

Laboratory surveillance of drinking water quality in Georgia is divided among a number of individuals and agencies. Sample collection is most often done by water utility personnel, but may be done by Water Supply Section personnel or county health department sanitarians. Analyses may be performed by the State Laboratory Section, private laboratories, or water utility laboratories. Only 45 percent of the 20 Class I and Class II supplies evaluated in this report met the bacteriological sampling frequency specified by State Rules and Regulations and the Federal Drinking Water Standards during 1972. Eighty-five (85) percent had received a chemical analysis by the Laboratory Section during the preceding three years. However, this analysis included few health related constituents of the Drinking Water Standards.

Bacteriological

The bacteriological laboratory services of the Environmental Protection Division are provided by the Laboratory Section. Drinking water bacteriology was formerly under the administrative control of the Water Supply Section, but was transferred into the Laboratory Section during the 1972 reorganization. The laboratory in Atlanta is the only state laboratory in operation at present. Others are planned for Brunswick and Albany in the next several years.

Bacteriological surveillance of public water supplies is required under Chapter 270-5-15 of the Water Supply Quality Control Rules and Regulations. All Class I and Class II supplies are required to submit at least three samples per month to the state laboratory for analysis. Class III supplies are required to submit one or more each six months. In addition, all Class I supplies and all Class II supplies serving a population in excess of 10,000 persons are required to maintain their own bacteriological laboratory and to analyze samples in accordance with the following schedule:

	Population Served		
Class of Supply	<5000	5000 to 50,000	>50,000
I	3 per week	50 per mo.	as FDWS*
II	3 per mo. to State	(10,000 to 50,000) 50 per mo.	as FDWS*

*Federal Drinking Water Standards

It is reported that while there are approximately 110 Class I and large Class II supplies which are required to provide their own laboratories, only 55 have done so. The Water Supply Section assists supplies in establishment of laboratories and in use of Standard Methods. Only laboratories coming under the Federal Interstate Carriers

Water Supply Certificate Program are presently certified by the State Program.

As part of this evaluation, the state drinking water bacteriology laboratory and one water plant laboratory were evaluated. (See Appendix E) The plant laboratory had previously been certified by the State. Both laboratories were found to be in substantial compliance with Standard Methods.

The bacterial drinking water standards applicable to water supplies in Georgia are included in the Rules and Regulations. These standards are adapted from the Federal Drinking Water Standards, although important differences are present. Generally, the Georgia Standards have been shortened and simplified, with the result that important provisions pertaining to both membrane filter and multiple tube techniques have been omitted. In addition, instructions regarding collection of check samples in response to an unsatisfactory routine sample have been made less precise. The Rules and Regulations specify that when coliform colonies in a single standard sample exceed 4/100 ml, check sampling shall be begun. However, the State bacterial sample reporting forms and State personnel instruct that check sampling shall be initiated on samples with 2 or more coliform organisms per 100 ml. Similarly, the Rules and Regulations specify that the arithmetic mean coliform density of all standard samples examined per month shall not exceed 1/100 ml. Compliance with this provision is not determined by either the Laboratory Section or the Water Supply Section. Instead, a determination is made of supplies for which 10 percent or more of all samples show 2 or more coliform organisms per 100 ml.

Laboratory results are normally reported by mail the same day the results are determined by the technicians. Reports of satisfactory samples are sent to the official designated by the supply, to the County Health Department, and to the District Health Unit. Reports of unsatisfactory samples are sent to those mentioned above plus the Mayor of the City or other responsible municipal or water supply officials designated by the supply, and to the Water Supply Section.

Sampling is generally clustered in groups of three samples because the State has promoted exclusive use of a reusable mailer which holds three sample bottles. When an unsatisfactory sample is detected, "additional samples" are requested on the laboratory report form. Three new samples are generally submitted if one initial sample or all three initial samples were unsatisfactory. A second group or check samples have recently begun to be requested in an attempt to secure two consecutive satisfactory results. Because of the necessity to return the mailer with additional bottles before check samples can be collected, 6 or 7 days elapse between collection of the unsatisfactory sample and collection of the first group of check samples, and another 6 or 7 days elapses before collection of subsequent check samples. No procedure is available to bring to attention those supplies which fail to submit check samples.

A spot check of the records for check sampling response in 116 cases yielded the following results:

-Check sampling ended with two negative samples	21
-Check sampling ended with one negative sample	43
-Check sampling was not performed although check samples were requested	52
	116

Laboratory results are recorded in the laboratory files. Also received, recorded, and filed are bacterial results submitted by utility laboratories performing drinking water analyses. Copies of these reports are also reviewed in the Water Supply Section.

Chemical

Chemical laboratory services of the Environmental Protection Division are provided by the Laboratory Section. The drinking water laboratory, formerly under the administrative control of the Water Supply Section, performs a large number of routine analyses. Samples collected in special investigations and a small number of routine samples receive more complex chemical analyses in the water pollution control laboratory.

Water Supply Section policy stipulates that each Class I and each Class II supply be analyzed at least annually. According to laboratory records, approximately 1,400 routine chemical analyses were performed last year. These analyses, however, generally consisted of measurement of only eight constituents, and only four of the 26 required by the

Federal Drinking Water Standards. At present, there is no capability to perform radio-chemical or organics (organics-carbon absorbable and organics-alcohol absorbable).

ACTIVITIES-PROGRAM NEEDS

Engineering

The findings of this evaluation generally document that the Water Supply Section is not providing the engineering services necessary to fulfill its responsibilities as specified in the Statute.

Field surveys made as part of this evaluation have shown unprotected sources of supply, deficient treatment facilities, deficient treatment operation, inadequate quality control, failures to meet standards in water quality and surveillance, and inadequate cross-connection control.

Shortage of staff and resources has forced the Water Supply Section to partially abandon hopes for an adequate surveillance and regulation program. In addition, performance of certain engineering activities is at times so hurried or incomplete as to be ineffective. A water supply program conducted in this manner promotes a false sense of security regarding the reliability of water systems in Georgia.

Priorities

The Environmental Protection Agency believes that a Water Supply Program should provide at least the following minimum level of services:

1. Review of all bacteriological and chemical data generated by State and water supply laboratories.

   Detailed monthly determination of compliance with established standards should be made, both as to quality and to frequency of sampling, with prompt follow-up on those supplies failing to meet prescribed standards.
2. Comprehensive field inspection of each system at least annually, with detailed written report and notification of deficiencies. Follow-up visits to check compliance may often be needed.
3. Complete engineering review of plans and specifications for all new construction and/or modifications to water system facilities, including complete record of pertinent points covered in the review.
4. Receipt and prompt review of all monthly operating reports from all supplies, with follow-up on those indicating problems.
5. On-site inspections during construction of water system facilities for compliance with approved plans and specifications.
6. Administration of the water system certification program as required by law and as a tool to obtain compliance with applicable rules and regulations.
7. Promotion of cross-connection control, both through actual consultation and inspections, and through working toward

establishment of cross-connection control programs in the local communities.

8. Operator training activity, both formally in short schools and informally through consultation by telephone and during field visits.
9. Active participation in planning agency or community meetings in order to promote the orderly development of new and/or expanded public water supplies.

The engineering activities established by the Water Supply Section and listed in the "Activities-Present Operation" section of this report are essentially the same as those listed above. However, due to lack of manpower and other resources, it has been necessary for the Water Supply Section to emphasize certain of these activities at the sacrifice of others.

Priorities established by the Water Supply Section appropriately list response to unsatisfactory water quality as being of highest concern. Also rated of high priority are activities related to plan review and approval. Routine water system inspections and the other activities fall below these in priority.

The EPA concurs with the necessity for establishment of priorities under existing circumstances. However, a satisfactory water supply program will require full effort in all activities.

Certificates of Approval

The Water Supply Section's program for issuance of Certificates of Approval to those supplies in compliance with the Rules and Regulations could provide a powerful tool for furthering the cause of safe drinking water in Georgia. However, with present program policies and manpower resources, the actual effectiveness of the program has not approached its potential.

Provisional Certificates were issued to hundreds of supplies which had significant deficiencies in facilities and/or operation with the stipulation that the Provisional Certificate would be invalid after one year. For the majority of these supplies, over one year has passed, and the Water Supply Section has not succeeded in bringing these supplies into compliance. Admittedly, manpower to conduct repeated inspections and provide necessary indoctrination and training has not been available. However, in those cases where attention has been directed and compliance has not been forthcoming, actions generally have not been taken to secure compliance by legal process or to disapprove the application for a certificate.

It is recommended that a comprehensive review of the Certification Program be conducted by the Water Supply Program. Those supplies whose Provisional Certificates are over one year old and whose deficiencies remain significant should be advised that their permit application has been disapproved. When applications are re-filed, Provisional Certificates should only be issued when deficiencies do not materially compromise public health protection. Among the terms of a Provisional Certificate should be a time schedule for correction of all deficiencies. Disapproval of a permit application or revocation of a Provisional Certificate should include a public notice by the Division setting forth the reasons for the action. If public interest and further negotiations do not obtain improvements within a short time, legally binding compliance orders should be issued. Supplies which have never applied for a Certificate of Approval should be actively sought out and their compliance with the Rules and Regulations ascertained. If improvements are not forthcoming, legally binding compliance orders should be issued.

Plan Review

Substantially increased emphasis has been placed on the plan review activity during the past year. Approval of water system extensions has been withheld in many instances where source or distribution system are inadequate. The Environmental Protection Agency supports use of this technique to prevent over-stressing systems with attendant potential health problems for all users. The success of the plan review program over recent years is questionable in light of water supply problems documented in Douglas County and other areas of the State. Sufficient time has not elapsed to judge the effectiveness of the present increased emphasis on this activity.

Record keeping for the plan review activity would benefit from several modifications. Microfilm files for storage of plans and specifications has proven useful for water supply programs in other states, and are recommended for the Georgia Water Supply Section. In addition, it is recommended that a worksheet be developed for use of the reviewing engineer in recording pertinent calculations and observations made during his review.

Training

The training program and operator certification appear to have made some impact on water supply practices at a limited number of systems. Much remains to be done, however, as evidenced by the number of supplies with significant deficiencies, and the large number of supplies which have not yet participated in the program. It is recommended that future expanded training activities include more regionalized courses which would permit participants to commute to daily or evening sessions. An optimum program would include one full-time staff member to direct and conduct training activities.

Laboratory

Bacteriological

The heart of a Water Supply Program's public health protection is the bacteriological surveillance activity. The necessity for improvement in this aspect of the Georgia program is supported by the findings of this study. Only 10 of 20 supplies evaluated had collected at least the minimum number of samples specified in the Federal Drinking Water Standards and in State Regulations each month of 1972. Two (2) supplies had collected no samples in 1972. Sixty (60) percent of the 20 supplies failed either to maintain satisfactory quality or to conduct adequate surveillance or both.

Responsibility for bacteriological surveillance is shared by the Water Supply Section and the Laboratory Section. The division of responsibility between the two sections is complicated by the fact that the laboratory's budget is included with the Water Supply Section while administrative supervision is provided by the Laboratory Section. Cooperation is needed in order to maintain appropriate lines of supervision while essential close coordination between the laboratory and the Water Supply Section is preserved.

The bacteriological drinking water standards included in the Rules and Regulations are derived from the Federal Drinking Water Standards, but have been modified, and have been made less strigent. It is recommended that all provisions of the Federal Drinking Water Standards be retained in new revisions of the Rules and Regulations. A related, and perhaps more serious, deficiency in the bacteriological surveillance program involves determination of compliance with the standards. The Federal Drinking Water Standards and the State Rules and Regulations stipulate that for samples analyzed by the membrane filter technique, the mean coliform density of all standard samples examined per month shall not exceed 1/100 ml. No attempt, however, is made to determine compliance with this standard. Instead, the Laboratory Section computes the percent positive samples per year. This practice originated when all samples were analyzed by multiple tube methods, under which a similar average should be computed each month to determine partial compliance with the standards. For membrane filter technique results, however, it has no application and should be abandoned. Furthermore, an unsatisfactory sample by the membrane filter procedure is defined in the Federal Drinking Water Standards as well as State Rules and Regulations as one showing in excess of four coliforms per 100 ml. The official State form which reports bacteriological results, however, defines unsatisfactory quality as two or more coliforms per 100 ml. This latter definition is also used by the laboratory staff to calculate the average and to signal the need for collection of check samples. This practice is in direct conflict with official Rules and Regulations and one or the other should be modified. Use of the 2 coliform per 100 ml definition is more stringent than the Federal Drinking Water Standards. If it is adopted, special handling of data from systems under interstate regulation will be needed.

Crucial to the health protection function of the Water Supply Program is immediate and decisive response when routine monitoring shows a potential or actual problem. Responsibility for such response rests principally with the Water Supply Section, although the laboratory has an essential role in making notification of results.

In March 1973 the Laboratory Section complied a list of publicly owned water supplies whose FY 73 bacteriological sampling record exceeded 10 percent positive. One hundred two (102) supplies, or approximately 20 percent of all publicly owned Class I and Class II systems were included on this list. While exceeding 10 percent positive as defined above is not sufficient information to conclude that Federal or State Standards had been exceeded, examination of the complete record for many of these supplies indicated that most or all would have failed the applicable standards.

Proper public health protection requires immediate notification of unsatisfactory bacteriological sample results in order that check sampling and remedial action may be begun. The laboratory mails reports the same day technicians determine results, and the laboratory report requests check samples. The reusable carton of three fresh sample bottles is also returned to the supply by mail. In the event of unusually heavy contamination of a sample, the laboratory may telephone the supply, the Water Supply Section, or the District Health Unit. Even with telephone notifications, however, check samples are not ordinarily collected immediately because the mail has not yet returned the sample bottles. Further delay often occurs because the laboratory cannot receive samples over weekends. In essentially all cases, 6 or 7 days elapse between collection of a sample which proves to be contaminated and collection of the first check sample. At least another 6 or 7 days elapses before another check sample can be collected. Longer delays often occur and are most often the fault of the sampler. However, the best possible response under the existing system would not provide adequate public health protection.

The Federal Drinking Water Standards specify that upon determination of unsatisfactory quality, daily samples from the same sampling point shall be collected promptly and examined until the results of at least two consecutive samples show the water to be of satisfactory quality. Promptly is interpreted to mean the same day or the day following receipt of laboratory report showing unsatisfactory quality. In order to provide such a response, the following changes in surveillance procedures are recommended:

1. Provide a supply of sample bottles to each supply for use in the event collection of check samples is in order.
2. Implement a policy for consistent telephone notification of unsatisfactory quality.
3. Revise laboratory schedule such that samples can be accepted over weekends and holidays, if necessary.
4. Establish a pending file to allow positive control of check samples to assure their submission.
5. Incorporate automatic data processing techniques to storage, analysis and retrieval of data.

Current procedures provide that the laboratory send the Water Supply Section copies of unsatisfactory sample results. Special referral of the record may be made by the laboratory in the event of acute or chronic contamination. An examination of laboratory records revealed 15 instances thus far in FY 73 where the record of a specific supply had been called to the attention of the Water Supply Section. In seven instances, the Water Supply Section files could not document any response to this notification. In the other eight instances, documented responses ranged from a compliance order signed by the Director, Environmental Protection Division, to a single engineering inspection approximately six weeks after the referral. In at least four instances, no additional bacteriological samples were recorded until 30 or more days after the supply's quality problem was referred to the Water Supply Section.

The foregoing illustrates inconsistency both in promptness and level of response as well as in documentation of what actions were taken.

Procedures instituted in early 1973 have impacted the deficiencies described above to a degree. A log of all unsatisfactory sample results has been developed, with telephone calls or other initial response noted. In addition, unsatisfactory sample report forms are now filed with hand-written notations documenting response made. Such records are essential, and maintenance and expansion of the system is strongly supported. It is not possible to judge effectiveness of newly instituted changes at this time.

More careful attention appears to be given to public health protection for municipal(publicly owned) supplies than to private systems which may serve as many people. It is recommended that all surveillance procedures be extended with equal vigor to all Class I and Class II supplies, regardless of ownership.

Chemical

Chemical surveillance of drinking water assumes increasing importance as natural waters become subject to industrial and agricultural waste discharges.

Although all but 3 of the twenty supplies examined had had a chemical analysis by the State in the past three years, these analyses included only eight constituents, only four of 26 which are included in the Federal Drinking Water Standards.

The principal needs of the chemical surveillance program are:

a. Expansion of the routine analysis to include all constituents of health consideration.

b. Provision for special analyses in the event of an unusual problem.

c. Adoption of a policy to make complete routine chemical analyses of public water supplies in accordance with the following schedule:

  -Surface water supplies at least twice per year
  -Groundwater supplies at least once each 3 years
  -Class III supplies at least once each 5 years

d. A record keeping system sufficient to allow easy storage and recovery of data and designed to bring to notice supplies whose analysis is not current. Sufficient clerical help to implement such a record keeping system is needed. Automatic data techniques should be explored for use in the chemical surveillance program.

RESOURCES - PRESENT OPERATION

Organization

The Environmental Protection Division is one of four Divisions of the Department of Natural Resources. The Division is headed by a Director and Deputy Director. There are five sections within the Division, each representing a categorical environmental program, as follows: Water Quality Control, Water Supply, Air Quality Control, Solid Waste Management, and Land Reclamation. A laboratory - field offices group includes Regional Offices in Albany, Brunswick, and Macon, and the main laboratories in Atlanta. An organization chart is shown in Figure 2.

Water Supply Section Staff

The Water Supply Section presently consists of seven professionals and two secretaries. Table I presents the merit system category, qualifications, and experience of the professional staff. It can be seen that two hold Masters Degrees, and five hold Professional Licenses.

Budget

The Water Supply Section's budget for fiscal year 1973 was $323,000. This amounts to approximately 11 percent of the total Environmental Protection Division budget. Included in this amount are funds to support both the water supply bacteriology and the water supply chemistry laboratories. It is estimated that approximately $139,000, or about 43 percent of the $323,000, was used to support the engineering activities of the Water Supply Section.

FIGURE II

GEORGIA DEPARTMENT OF NATURAL RESOURCES

ENVIRONMENTAL PROTECTION DIVISION

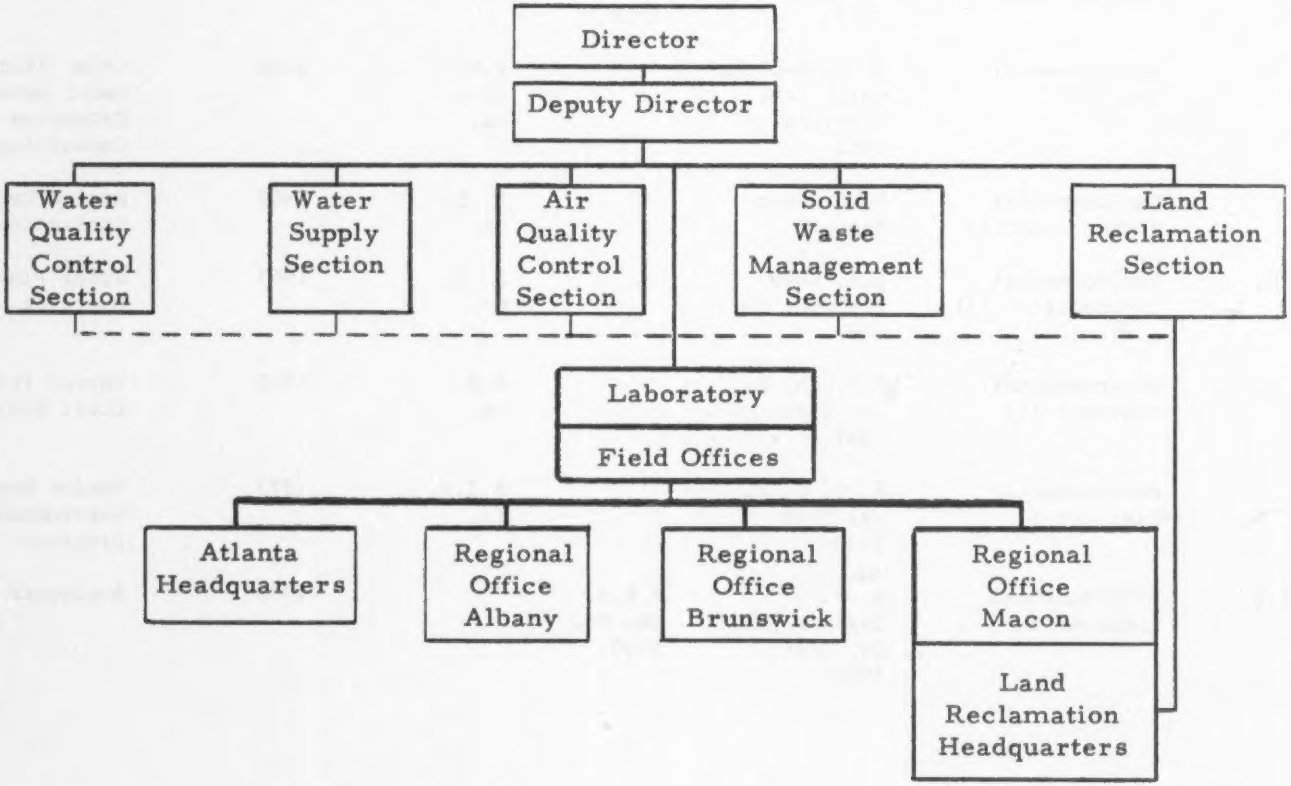

Director
Deputy Director
Water Quality Control Section
Water Supply Section
Air Quality Control Section
Solid Waste Management Section
Land Reclamation Section
Laboratory
Field Offices
Atlanta Headquarters
Regional Office Albany
Regional Office Brunswick
Regional Office Macon
Land Reclamation Headquarters

FIGURE II

GEORGIA DEPARTMENT OF NATURAL RESOURCES

ENVIRONMENTAL PROTECTION DIVISION

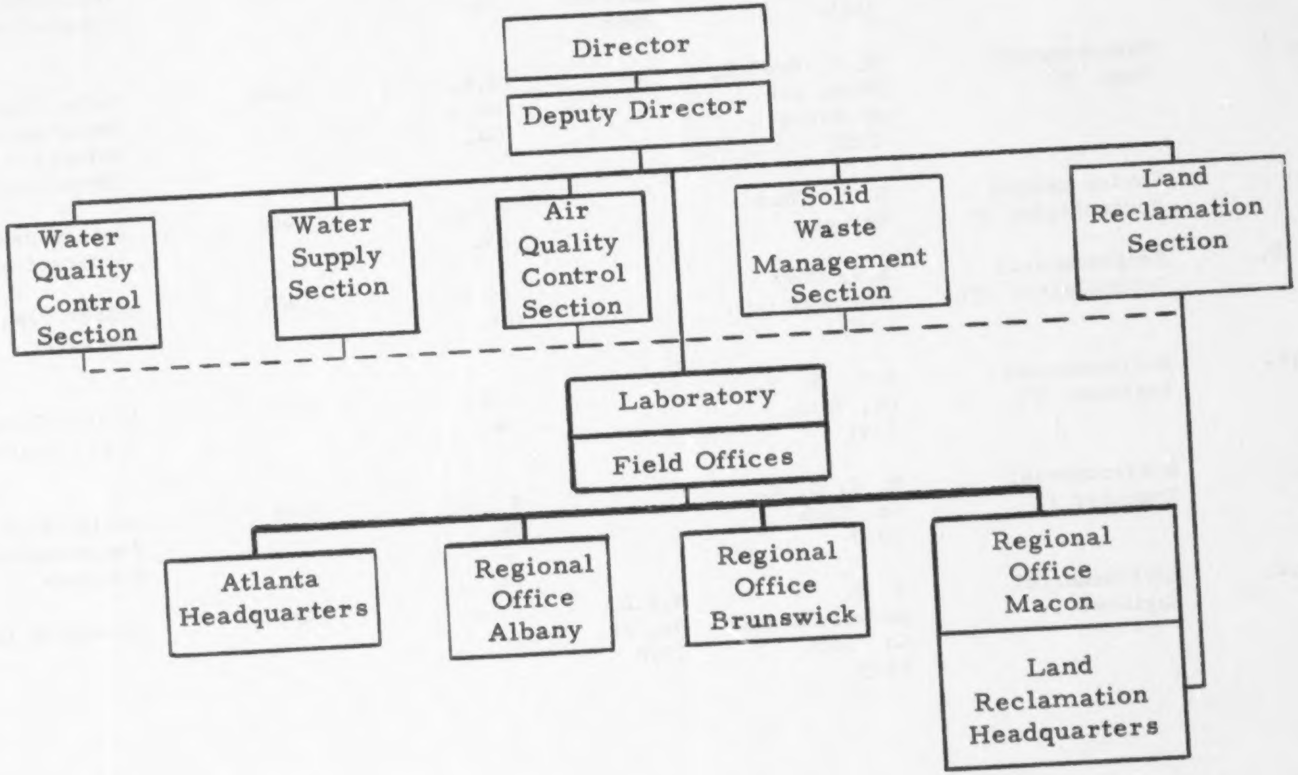

Director
Deputy Director
Water Quality Control Section
Water Supply Section
Air Quality Control Section
Solid Waste Management Section
Land Reclamation Section
Laboratory
Field Offices
Atlanta Headquarters
Regional Office Albany
Regional Office Brunswick
Regional Office Macon
Land Reclamation Headquarters

TABLE I

WATER SUPPLY PROGRAM PROFESSIONAL STAFF QUALIFICATIONS

Staff Member	Category	Bachelors Degree	Masters Degree	Prof. Regis.	Joined Ga. W. S. Prog.	Previous Experience
Byers, R. H.	Dir. Environ. San. Services	B. S. Ch. E. Ga. Tech 1939	S. M. Harvard 1953	P. E. Ga.	1963	Industrial W. S. Industrial Hygiene
Fernstrom, J.	Environmental Engr. IV	B. S. Geol.E. Colo. Sch. of Mines 1953		P.E. Colo. Ga.	1966	Colo. State Div. of Water Resources Extensive Geol. Consulting
Arnold, P.	Environmental Technologist IV	B. S. Chem Mercer		R. S. Ga.	1969	Health Dept. Sanitation
Finlay, F. O.	Environmental Technologist III	B.S. Chem Piedmont Col. 1963		R. S. Ga.	1963	Water Plant Operator
Carmichael,B.	Environmental Engineer III	B.S. Ch. E. Ga. Tech. 1941		P.E. Ga.	1970	Varied Industrial Civil Engineering
Stiles, H.	Environmental Engineer II	B. S. C. E. Ga. Tech 1970		E.I.T. Ga.	1973	Health Dept. Environmental Programs
Prescott, L.W.	Environmental Engineer I	B. S. Ceramic Engr. Ga. Tech 1965	M.B.A. Ga. St. 1970		1973	Aerospace Industry

The Water Supply Section's annual budgets for the past ten years are tabulated below.

Year	Annual Budget
1964	$156,000
1965	$147,000
1966	$155,000
1967	$176,000
1968	$202,000
1969	$200,000
1970	$227,000
1971	$266,000
1972	$258,000
1973	$323,000

The apparent increases in funds available do not represent significant increase in ability to provide services, with the possible exception of the bacteriology laboratory which has nearly doubled the number of samples analyzed in recent years. Staffing levels for engineering personnel have remained essentially constant during this period, and the larger budgets reflect rising salaries, travel expenses, and equipment costs.

It is estimated that $139,000 is expended at the State level for engineering surveillance and support of public drinking water supplies. Based on this, and assuming no State level effort is expended on Class III supplies, about $70.50 is spent by the State for each of the estimated 1,976 Class I and Class II public water supplies.

Deployment

All present staff of the Water Supply Section operate out of the Atlanta office. All portions of the State are covered out of the headquarters offices, although the Division's plans reportedly include staffing regional offices in the near future.

Other Assistance

Prior to the passage of the Executive Reorganization Act of 1972, which transferred the Water Supply Section from the State Department of Health into the Department of Natural Resources, considerable water supply assistance was received from the District and local health units. Assistance consisted of routine engineering inspections of public supplies and at times assistance with emergency response to problems. Further, a State Board of Health resolution authorized local health departments to maintain surveillance over Class III supplies, and pursuant to this all routine surveillance of Class III supplies was conducted by local health departments. The Executive Reorganization Act dissolved the official organization connection between the Water Supply Section and the local health departments, and as a result, much assistance formerly available has been lost. Many local health department personnel, however, have continued to provide some assistance on drinking water matters.

RESOURCES - PROGRAM NEEDS

Organization

The Water Supply Program joined other environmental programs under the Environmental Protection Division in 1972. Organizationally, it has been given equal status as a Section with the other more fully staffed and funded environmental programs. This equality is considered appropriate to the importance of the Water Supply Program's mission.

It is important that the Water Supply Section and the Water Supply Laboratory receive its equitable share of overall Environmental Protection Division administrative services and financial support. In addition, it is recommended that a comparison be made of salaries received by water supply program personnel and by those with comparable responsibilities in the other Environmental Protection Division programs. Adjustments should be made if disparities are found.

Services provided by the Laboratory Section are essential to the Water Supply Program. Laboratory policies, priority establishment, and assignment of staff has been assumed by the Laboratory Section, although funding for the water supply bacteriology and water supply chemistry laboratories has remained with the Water Supply Section for fiscal accounting purposes. Administrative leadership is needed to assure that while laboratory personnel receive overall supervision from the Laboratory Section, essential day to day working staff communications continue with the Water Supply Section. In the interest of consistency and efficient management, the budgets for the laboratory should be separated from the Water Supply Section.

Water Supply Section Staff

The present staff of the Water Supply Program is not adequate to perform all of the essential services of a satisfactory program as defined in the Activities - Program Needs section of this report. A principal objective of this report is to estimate staffing needs for an adequate program.

In order to provide the foundation for an accurate estimate of personnel needs for an adequate Georgia Water Supply Program, a complete inventory of public or community water supply systems is needed. Such a complete inventory is not presently available. Estimates are available for population served by 576 municipal water systems, and type of treatment for these supplies and other Class II supplies is known. However, population served by privately owned Class II supplies is not fully known, and little is known about Class III supplies, with even the number of such supplies being "best estimates". In the absence of a more complete inventory, estimated personnel requirements developed in this report may need to be refined when better information becomes available.

The Environmental Protection Agency has estimated previously that on the average, at least four man-days per year of engineering time are required for each public water system. Since Georgia systems are classified and inventoried according to type of source, it is possible to refine this estimate. Class I supplies (surface water source) are estimated to require an average of eight man-days per year, and Class II supplies (ground water source), many of which are small, are estimated to require an average of two man-days per year. It is further estimated that Class III supplies (small, privately owned) require one man-day per year.

Based on these assumptions, personnel requirements are estimated as follows:

1. Class I systems

   89 systems x 8 $\frac{\text{man-days}}{\text{system}}$ = 712 man-days

2. Class II systems

   1,887 systems x 2 $\frac{\text{man-days}}{\text{system}}$ = 3,774 man-days

3. Class III systems

   4,200 systems x 1 $\frac{\text{man-days}}{\text{system}}$ = 4,200 man-days

4. Cross-connection control

	Number		Man-days	Man-days	
Population	Class I	Class II	System	Class I	Class II
50,000 and over	7	3	4	28	12
10,000 to 49,999	13	20	3	39	60
1,000 to 9,999	58	115	2	116	230
less than 1,000	11	349	1	11	349
Class II (private)		1,400	1/2		700

Based on the preliminary numerical estimates developed above, and using 220 man-days as equal to one man-year, the following approximate annual personnel needs for a satisfactory water supply program are submitted:

Class I systems	
Engineering:	3½ men
Cross-connection control:	1 man
Class II systems	
Engineering:	17 men
Cross-connection control:	
Class II Public	3 men
Class II Private	3 men
Class III systems	
Engineering:	19 men

In the interest of economy and efficient use of professional personnel, cautious substitution of technicians for engineers or other professionals may be made. Of the personnel needs defined above for Class II and Class III supplies, as many as one-third could be trained technicians without full professional qualifications. Training, supervision, and special problems should be handled by professional personnel.

Secretarial help is essential to efficient and effective operation of an expanded Water Supply Program. It is recommended that one secretary be added to the staff for each three professionals added and for each five technicians.

Phased Staffing Plan

As estimated above, a fully satisfactory Georgia Water Supply Program would require at least from 27 to 46 technical personnel, depending on the amount of assistance received from local health departments on

Class III supplies. In addition, a secretarial staff of from 8 to 12 is needed for support services.

While estimated ultimate staff as indicated above would enable accomplishment of all activities in a fully satisfactory program, certain activities must be assigned such high priority that immediate accomplishment is indicated. Among these critical Water Supply Program activities are: on-site water system inspections annually or more often; comprehensive daily review of bacteriological and chemical sampling records, with follow-up on those failing to meet standards; detailed plan review with on-site inspection of construction, and review of monthly operational reports with follow-up on those indicating problems.

The recommended ultimate staff amounts to a four to six-fold increase over the present staff of seven professionals. While sufficient staff to accomplish essential tasks is needed, it is not considered advisable to add personnel at a rate greater than they can be properly recruited, oriented, trained, and assimilated into the program. For this reason, a phased increase in Water Supply Program staff is recommended. With proper management, proposed staff at the end of FY 74 would be sufficient to perform essential surveillance activities for Class I and II public supplies. Full services for private Class II systems and Class III systems can not be provided until further increments in staff are made. The following general pattern of staff increases is proposed.

		Technical Staff	
Fiscal Year	Existing Staff Start of FY	To Be Added During FY	Staff at End of FY
74	7	8	15
75	15	8	23
76	23	8	31
77	31	Varies depending on extent of surveillance for Class III supplies provided by others.	
		Clerical Staff	
74	2	2	4
75	4	3	7
76	7	2	9
77	9	Varies depending on extent of surveillance for Class III supplies provided by others.	

Budget

The FY 73 budget for the Water Supply Program, including bacteriological and chemical laboratory activities, was $323,000. Of this, $139,000 supported the engineering activities located in the Water Supply Section.

Cost of the fully satisfactory Water Supply Program recommended by the Environmental Protection Agency is estimated below. Assumptions employed are as follows:

Engineering

a. Average cost per professional per year:

Salary	$14,500
Fringe benefits	2,500
Travel	2,000
Misc.	1,000
TOTAL	$20,000

b. Average cost per clerical employee per year:

Salary	$7,000
Fringe benefits	1,500
TOTAL	$8,500

Recommended staff increases and estimated budget are summarized as follows:

Staffing

FY	Staff begin FY		Staff to be added	
	Prof.	Clerical	Prof.	Clerical
74	7	2	8	2
75	15	4	8	3
76	23	7	8	2

Budget

FY	Additional Costs Added During FY	Program Costs at End FY
73	-	$139,000 (actual)
74	$177,000	$316,000
75	$185,500	$501,500
76	$177,000	$678,500

The increases proposed for the Water Supply Program amount to an approximately a four-fold increase in staff and budget. Expressed another way, it may be said that the present Georgia program provides only about one-fourth of what is needed to adequately protect public health.

Laboratory - Bacteriological

Records maintained by the Laboratory Section indicate that approximately 40,000 drinking water bacteriological samples are analyzed annually in the Atlanta laboratory.

Based on estimates of the number and size of Class I, Class II, and Class III supplies presently in the State, and applicable State Rules and Regulations, it can be shown that approximately 80,000 bacteriological samples should be examined in State laboratories annually. If these estimates are revised to include the level of surveillance for Class III supplies recommended in this report, approximately 180,000 bacteriological samples should be analyzed annually at the State laboratory or at laboratories approved by the State.

To estimate the cost of these additional bacterial analyses, the following calculations were employed:

Total Water Supply Section Budget	$323,000
Cost of Engineering Activities	-139,000
Laboratory Operating Budget	184,000
Est. Cost of Chemistry Laboratory	-27,000
Bacteriology Laboratory Budget	157,000
Est. Cost of Stream Sample Analyses	-47,000
Est. Cost of Drinking Water Bact.	$110,000

$$\frac{\$110{,}000}{40{,}000} = \$2.75 \text{ per sample}$$

80,000 samples @ $2.75 = $220,000

In order to provide bacteriological laboratory capability to satisfy existing State requirements, of approximately 80,000 analyses per year, approximately $220,000 are needed annually for drinking water bacteriology. This amounts to an increase of $110,000 over the FY 73 budget. Capability to provide bacteriological support for a fully satisfactory Water Supply Program will require analysis of approximately 180,000 samples annually at an estimated cost of $495,000. These estimates do not include adjustment for inevitable increases in the number of supplies which should be monitored.

In keeping with the phased staffing increases proposed for the Water Supply Section, it is recommended that one bacteriologist and one clerk be added to the bacteriology laboratory staff to handle increased workload anticipated for the near future. Further personnel increases should be made as workload and space dictate.

Establishment of bacteriolgical laboratories in the Brunswick and Albany Regional Offices is strongly supported. Initial staffing should be at least one bacteriologist and one technician with appropriate clerical assistance. A second bacteriologist should be aded during the laboratory's second year of operation.

It is also recommended that one experienced bacteriologist be added to the Atlanta staff to implement a statewide laboratory inspection and approval program. Approved laboratories located around the State will provide better response to emergencies and will assume part of the workload presently carried by the Atlanta laboratory.

Laboratory - Chemical

It has been estimated that approximately $27,000 are expended annually on the water supply chemistry laboratory.

In order to provide chemistry laboratory capability to meet recommended levels of surveillance, staff increases have been recommended. Based on the estimated cost of professional and clerical personnel developed above, cost of additional personnel needed is estimated below.

FY	Personnel Needs		Est. Cost	
	Prof.	Clerical	Prof.	Clerical
74	1	1	$20,000	$8,500
75	1		20,000	
76	1		20,000	
		TOTAL	$68,500	

Increased laboratory services are essential to a fully satisfactory Water Supply Program. Budgetary support for these essential services is needed.

Staffing Deployment

The Environmental Protection Division has established policy to fully staff regional offices at Brunswick, Albany, and Macon, as well as the combination headquarters and northwestern regional office in Atlanta. In support of this policy, it is therefore recommended that the eight new professional positions proposed for FY 74 be appropriately distributed between the four locations.

It is also recommended that high priority be given to full staffing of regional offices in assigning further additions to the Water Supply Program staff proposed for FY 75 and FY 76. At least two staff members of the Water Supply Program at each regional office are needed to provide needed field surveillance and emergency response.

Other Assistance

Needed surveillance of Class III supplies can only be provided by a large field staff located throughout the State. Since County Health Department personnel have, in the past, provided surveillance over these supplies, and county personnel are scattered throughout the State, it is recommended that arrangements be pursued to obtain County Health Department assistance. Special training, standards of operation and maintenance, and technical assistance should be provided by the Water Supply Section.

PARTICIPANTS

The following persons and/or agencies made a major contribution to the successful completion of this study.

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Georgia Environmental Protection Division, Atlanta
Fluoride Laboratory, Arlington, Virginia (EPA)
Gulf Coast Water Supply Research Laboratory, Dauphin Island, Ala.(EPA)
Montgomery Environmental Radiation Laboratory (EPA)

Report Preparation

D. H. Taylor, Water Supply Engineer
G. D. Hutchinson, Chief, Water Supply Section
R. L. Wright, Environmental Geologist
Louise H. Hood, Secretary
Judy J. Anderson, Secretary

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APPENDICES

APPENDIX A

TABLE I

PUBLIC WATER SYSTEMS STUDIED

[illegible]	SYSTEM NAME	POPULATION SERVED	AVERAGE DAILY DEMAND (MGD)	SOURCE	TREATMENT /1
1	Albany	63,000	13	20 Wells	DF1
2	Athens	60,000	11	N. Oconee R. & Sandy Cr.	CSFDF1
3	Atlanta	650,000	103	Chattahoochee R.	CSFDF1T&O
4	Broxton	975	.10	2 Wells	D (Not in use)
5	Columbus	167,000	25	Chattahoochee R.	CSFD
6	Ellijay	2,000	1.55	Ellijay R. Cartegay R. Joyce Sp.	CSFDF1 CSFD D
7	Folkston	2,700	.5	2 Wells	AD (Not in use)
8	Habersham Mills	200	.048	Unnamed Br. Soque R.	CSFD
9	Hawkinsville	4,000	.074	2 Wells	PASFD
10	Henry County Water System	10,100	.417	Clayton Co. & McDonough (Fin. water)	None
11	Kensington Water Authority	2,700	.692	2 Wells, 2 Springs	D
12	Lawrenceville	7,000	.95	Gwinnet Co. (Fin. Water)	None
13	Midville	840	.09	1 Well	D (Not in use)
14	Mitchell	160	.02	2 Wells	D (Not in use)

TABLE I (Cont'd)

PUBLIC WATER SYSTEMS STUDIED

SYSTEM #	SYSTEM NAME	POPULATION SERVED	AVERAGE DAILY DEMAND (MGD)	SOURCE	TREATMENT /1
15	Monticello	2,500	.350	Popes Branch & Nelsons Branch	CSFDFl
16	Oak St. Sub. (Valdosta)	700	.07	2 Wells	D
17	Odum	375	.038	1 Well	D (Not in use)
18	Azalea Pk Annex (Savannah)	300	.03	2 Wells	None
19	Reidsville	1,500	.15	2 Wells	D (Not in use)
20	Thomasville	22,000	3.2	5 Wells	LL_ACSFDFl

/1 A - Aeration
C - Coagulation
S - Sedimentation
F - Filtration
D - Disinfection
L - Lime
L_A - Soda Ash
Fl - Fluoridation
P - Phosphates
T&O - Taste & Odor (Carbon)

APPENDIX A

TABLE II

PUBLIC WATER SUPPLY SURVEILLANCE

SYSTEM	BACTERIOLOGY LAB.		1972 BACTERIOLOGICAL SAMPLES				BACTERIOLOGICAL QUALITY	SYSTEM SURVEILLANCE	
NO.	Lab. Used	Certification	Min. Req/Mo.	No. Min. Not Met	Range	Mo/No. Samples	Months Fail DWS	SHD Insp.	SHD Chemistry
1	Plant	State	70	0	86-92	0	0	No Record	5- 4-72
2	State & Plant	None(plant)	70	0	72-82	0	0	4- 8-71	12-11-72
3	State & Plant	EPA & State	250	0	250-352	0	0	8-12-72	11- 1-71
4	State	EPA	2	10	0-3	10	1	11-29-72	12- 6-71
5	State & Plant	EPA & State	150	0	153-165	0	0	2- 9-71	4- 4-72
6	State	EPA	2	0	3-3	0	0	12-14-72	9- 2-71
7	State	EPA	3	10	0-3	10	2	10-20-72	2- 1-71
8	State	EPA	2	2	0-3	2	0	No Record	No Record
9	State	EPA	4	12	0-3	2	0	11- 3-72	12- 1-70
11	State	EPA	13	12	0-5	10	0	No Record	12-11-72
11	State	EPA	3	0	3-3	0	0	3-31-72	6- 6-72
12	State	EPA	8	12	0-3	6	0	5- 5-72	4-20-71
13	State	EPA	3	0	3-3	0	2	2-10-72	9-14-70
14	State	EPA	2	1	0-3	1	0	9-22-71	4-19-71

TABLE II (Cont'd)

PUBLIC WATER SUPPLY SURVEILLANCE

SYSTEM	BACTERIOLOGY LAB.		1972 BACTERIOLOGICAL SAMPLES				BACTERIOLOGICAL QUALITY	SYSTEM SURVEILLANCE	
No.	Lab. Used	Certification	Min. Req/Mo.	Mo. Min. Not Met	Range	Mo/No. Samples	Months Fail DWS	SHD Insp.	SHD Chemistry
15	State	EPA	3	0	3-17	0	2	6- 2-71	4-14-70
16	State	EPA	2	6	0-4	6	2	No Record	5-11-70
17	State	EPA	2	5	0-3	5	1	3-16-67	10-18-71
18	State	EPA	2	12	0	12	NA	1-23-73*	No Record
19	State	EPA	2	2	0-2	2	1	No Record	3- 3-72
20	State & Plant	EPA & State	26	0	48-104	0	0	2-24-72*	4-11-72

*County Health Department

NA - Not applicable - cannot be evaluated

APPENDIX A

TABLE III

PUBLIC WATER SUPPLY SYSTEM RELIABILITY RATING

SYSTEM NO.	SOURCE			TREATMENT PLANT				DISTRIBUTION SYSTEM			DEFICIENCY RATING /1
	QUALITY	QUANTITY	PROTECTION	FACILITIES	OPERATION	MAINTENANCE	TESTS & RECORDS	STORAGE	PRESSURE	CHLORINE	
1	OK	OK	OK	OK	OK	OK	OK	X	OK	X	2
2	X	OK	OK	X	OK	OK	OK	X	OK	OK	3
3	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	0
4	OK	OK	OK	X	X	OK	X	X	OK	X	5
5	OK	OK	X	OK	OK	OK	OK	OK	OK	OK	1
6	X	OK	X	X	X	X	X	X	OK	OK	7
7	OK	OK	X	X	X	X	X	X	OK	X	7
8	OK	OK	OK	X	X	OK	X	X	OK	OK	4
9	OK	OK	X	X	X	X	X	X	OK	X	7
10	NE	NE	NE	OK	OK	OK	X	OK	OK	OK	1
11	OK	OK	X	X	X	OK	X	OK	OK	X	5
12	NE	NE	X	OK	OK	OK	X	OK	OK	OK	2
13	OK	OK	OK	X	X	X	X	OK	OK	X	5
14	OK	OK	OK	X	X	OK	X	OK	OK	X	4
15	OK	OK	OK	X	X	X	X	OK	OK	OK	4
16	OK	OK	X	X	X	X	X	X	OK	X	7

APPENDIX A (CONT'D)

TABLE III

PUBLIC WATER SUPPLY SYSTEM RELIABILITY RATING

SYSTEM	SOURCE			TREATMENT PLANT				DISTRIBUTION SYSTEM			DEFICIENCY
NO.	QUALITY	QUALITY	PROTECTION	FACILITIES	OPERATION	MAINTENANCE	TESTS & RECORDS	STORAGE	PRESSURE	CHLORINE	RATING /1
17	OK	OK	OK	X	OK	OK	X	OK	OK	OK	2
18	OK	OK	OK	X	OK	OK	X	X	OK	X	4
19	X	OK	X	X	X	X	X	X	OK	X	8
20	OK	OK	X	OK	OK	OK	OK	OK	OK	OK	1

NE - Not evaluated
X - Deficient
OK - Satisfactory
/1 - Represents number of deficiencies in ten categories listed in Table
"0" indicates least risk
"10" indicates most risk

APPENDIX A

TABLE IV

PUBLIC WATER SUPPLY QUALITY AND SURVEILLANCE RATING

SYSTEM NO.	BACTERIOLOGICAL QUAL.	BACTERIOLOGICAL MONITORING	BACTERIOLOGICAL LAB. CERT.	CHEMICAL /1 REC. STDS.	CHEMICAL /1 MAND. STDS.	QUALITY PROTECTION STATE INSP.	QUALITY PROTECTION OPER. CERT.	QUALITY PROTECTION CROSS-CONN.	RATING /2
1	OK	OK	OK	OK	OK	X	OK	X	1
2	OK	OK	X	OK	OK	X	OK	X	2
3	OK	OK	OK	OK	OK	OK	OK	OK	0
4	X	X	OK	OK	OK	OK	X	X	6
5	OK	OK	OK	OK	OK	X	OK	X	1
6	OK	OK	OK	OK	OK	OK	X	X	1
7	X	X	OK	OK	OK	OK	OK	X	5
8	IND.	X	OK	OK	OK	X	OK	OK	3
9	IND.	X	OK	OK	OK	OK	X	X	5
10	IND.	X	OK	OK	OK	X	X	X	5
11	OK	OK	OK	OK	OK	OK	OK	X	1
12	IND.	X	OK	OK	OK	OK	X	X	5
13	X	OK	OK	OK	OK	OK	X	X	6

TABLE IV (Cont'd)

PUBLIC WATER SUPPLY QUALITY AND SURVEILLANCE RATING

SYSTEM NO.	BACTERIOLOGICAL QUAL.	BACTERIOLOGICAL MONITORING	BACTERIOLOGICAL LAB. CERT.	CHEMICAL /1 REC. STDS.	CHEMICAL /1 MAND. STDS.	QUALITY PROTECTION STATE INSP.	QUALITY PROTECTION OPER. CERT.	QUALITY PROTECTION CROSS-CONN.	RATING /2
14	OK	OK	OK	Fe(.56)Zn(22.0)	OK	X	X	X	3
15	OK	OK	X	OK	OK	X	OK	X	2
16	X	X	OK	OK	OK	X	OK	X	5
17	X	X	OK	OK	OK	X	X	X	6
18	IND.	X	OK	OK	OK	OK	X	X	5
19	X	X	OK	OK	OK	X	X	X	6
20	OK	OK	OK	OK	OK	OK	OK	X	1

IND. = indeterminant - two or more months with no bacteriological record, hence quality is unknown.
X = deficient
OK = satisfactory
/1 = only constituents failing to meet standards are noted.
/2 = represents deficiencies in eight categories listed in Table. Deficiency in bacteriological quality or monitoring counted two points each, as did failing mandatory chemical standard. Indeterminant bacteriological quality counted one point. State inspection was not counted.
"0" indicates least risk
"10" indicates most risk

APPENDIX A

TABLE V

SUMMARY OF PUBLIC WATER SYSTEM DEFICIENCIES

SYSTEM NO.	WATER QUALITY		SURVEILLANCE			FACILITIES RELIA. RATING	QUAL. & SURVEILL. RATING	STATUS IN STATE PERMIT PROG.
	BACTERIAL	CHEMICAL	BACTERIAL	CHEMICAL	SHD			
1	OK	OK	OK	OK	X	2	1	Appr.
2	OK	OK	OK	OK	X	3	2	Appr.
3	OK	OK	OK	OK	OK	0	0	Appr.
4	X	OK	X	OK	OK	5	6	Prov.
5	OK	OK	OK	OK	X	1	1	Appr.
6	OK	OK	OK	OK	OK	7	1	Prov.
7	X	OK	X	OK	OK	7	5	Prov.
8	IND.	OK	X	X	X	3	3	Prov.
9	IND.	OK	X	OK	OK	7	5	Prov.
10	IND.	OK	X	OK	X	1	5	None
11	OK	OK	OK	OK	OK	5	1	Prov.
12	IND.	OK	X	OK	OK	2	5	Prov.
13	X	OK	OK	OK	OK	5	4	Prov.

SUMMARY OF PUBLIC WATER SYSTEM DEFICIENCIES

SYSTEM NO.	WATER QUALITY		SURVEILLANCE			FACILITIES RELIA. RATING	QUAL. & SURVEILL. RATING	STATUS IN STATE PERMIT PROG.
	BACTERIAL	CHEMICAL	BACTERIAL	CHEMICAL	SHD			
14	OK	X_r	OK	OK	X	4	3	Prov.
15	X	OK	OK	OK	X	4	2	Prov.
16	X	OK	X	X	X	7	5	Prov.
17	X	OK	X	OK	X	2	6	Prov.
18	IND.	OK	X	X	OK	4	5	None
19	X	OK	X	OK	X	8	6	Prov.
20	OK	OK	OK	OK	OK	1	1	Appr.

X = deficiency

IND. = indeterminant - two or more months with no bacteriological record, hence quality is unknown.

X_r = One or more chemical constituents failed the recommended (esthetic) limits of the Federal Drinking Water Standards.

X_m = One or more chemical constituents failed the mandatory (health) limits of the Federal Drinking Water Standards.

OK = Satisfactory

APPENDIX A

TABLE VI

PUBLIC WATER SUPPLY OPERATORS AND OPERATION

SYSTEM NO.	OPERATOR				QUALITY		RELIABILITY RATING	QUALITY & SURV. RATING	STATE PERMIT
	FULL TIME	SPECIAL TRAINING	TIME ON JOB	CERTIFIED	BACT.	CHEM.			
1	Yes	Short School	19 Years	Yes	Ok	Ok	2	1	Approved
2	Yes	Short School	8 Years	Yes	Ok	Ok	3	2	Approved
3	Yes	Coll.-Sh. Sch.	24 Years	Yes	Ok	Ok	0	0	Approved
4	No	None	1 Month	No	X	Ok	5	6	Provisional
5	Yes	Short School	27 Years	Yes	Ok	Ok	1	1	Approved
6	Yes	None	3 Months	No	Ok	Ok	7	1	Provisional
7	Yes*	Short School	9 Years	Yes	X	Ok	7	5	Provisional
8	Yes	Short School	6 Years	Yes	Ind.	Ok	4	3	Provisional
9	Yes	Short School	5 Years	No	Ind.	Ok	7	5	Provisional
10	Yes*	None	10 Years	No	Ind.	Ok	1	5	None
11	Yes	None	4 Years	Yes	Ok	Ok	5	1	Provisional
12	Yes*	None	14 Years	No	Ind.	Ok	2	5	Provisional
13	No	None	8 Years	No	X	Ok	5	4	Provisional
14	No	None	5 Years	No	Ok	C	4	3	Provisional

TABLE VI (Cont'd)

PUBLIC WATER SUPPLY OPERATORS AND OPERATION

SYSTEM NO.	OPERATOR				QUALITY		RELIABILITY RATING	QUALITY & SURV. RATING	STATE PERMIT
	FULL TIME	SPECIAL TRAINING	TIME ON JOB	CERTIFIED	BACT.	CHEM.			
15	Yes	Short School	3 Years	Yes	X	Ok	4	2	Provisional
16	No	Short School	1 Year	Yes	X	Ok	7	5	Provisional
17	No	None	1 Year	No	X	Ok	2	6	Provisional
18	No	None	1 Year	No	Ind.	Ok	4	5	None
19	Yes	None	11 Years	No	X	Ok	8	6	Provisional
20	Yes	Short School	31 Years	Yes	Ok	Ok	1	1	Approved

X - Deficiency
OK - Satisfactory
* - Operator has other responsibilities besides operation of water system.
Ind. - indeterminant - two or more months with no bacteriological record, hence quality is unknown.
C - Recommended (esthetic) chemical limit exceeded.

APPENDIX B

GEORGIA CLASS III PUBLIC WATER SUPPLIES

Introduction

Public and community water supplies are not defined by the Georgia Statutes, but are defined in Rules and Regulations for Water Supply Quality Control as including water supply systems serving water for domestic purposes to the public except those serving a single family dwelling. The Rules and Regulations further classify public and community water supply systems as Class II, and Class III. Class III systems are those serving fewer than 25 dwelling units or 100 employees and include such establishments as tourist accommodations, restaurants, motels, small trailer parks and subdivisions.

The Executive Reorganization of 1972 transferred Water Supply Program activities from the State Health Agency to the Department of Natural Resources. County Health Departments and other Health functions were transferred to the Department of Human Resources. Formerly, the Water Supply Program was dependent upon County Health Departments for Class III water system surveillance through official agreement. Although these departments are no longer within the same organizational unit, County Health Department surveillance of Class III supplies has continued.

Class III water systems influence the health of many people, and are properly included in the enforceable State regulations. Therefore, it was necessary to include them in the Georgia Water Supply Program Evaluation. A large number of these systems make water available for public use at a variety of private and commercial establishments. Information regarding the extent of public health protection, number of persons served and the number of these systems was not generally available in the Georgia Department of Natural Resources files.

Counties Surveyed

Three counties were selected to be surveyed and sampled in order to evaluate the present condition of Georgia Class III water systems and to ascertain if additional health agency surveillance may be necessary to assure public health protection. These counties were Cook County in south Georgia, Jones County in middle Georgia, and Forsyth County in northeast Georgia. It was generally agreed that data assembled from the three counties in question could reasonably describe the condition of Class III water systems in Georgia.

Cook County occupies a portion of the southern-most tip of the coastal plains. The present land form has been lowered by erosion to nearly a plain, making Cook County predominantly suited for agriculture. Nearly all of the surface water drained from northern, eastern, and central Cook County goes into the Suwannee River.

The sedimentary rocks of the coastal plain consist of alternating layers of sand, clay, and limestone, with sand and limestone being the principal aquifers. The sedimentary rocks of the coastal plain crop out beginning at the Fall Line and dip gently to the south and southeast. The stratigraphic unit from which Cook County obtains its groundwater is known as the Ocala Limestone formation. This unit thickens up to (300) feet in most of Cook County, and has a history of yielding as much as 1,700 gpm. The quality of water from the Ocala aquifer is usually excellent. The water is of a calcium bicarbonate type and is moderately hard and slightly alkaline.

Jones County forms the northwestern corner of a quardrant county series. It is bounded on the west by the Ocumulgee River. Approximately 75 percent of the northern area of Jones County is in the Piedmont Province. The Piedmont is a series of prominent hills near the base of the mountains which change to flat-topped undulating hills toward the south. The development of the present land surface has been brought about almost entirely by the action of stream erosion. This region has deep hills of red clayey soils which gully rapidly when the vegetation is removed.

The crystalline metamorphic and igneous rock of the Piedmont crop out in the area to the north of the coastal plain in Jones County. These rocks consist of granite gneiss, biotite gneiss and some mica schist. Wells that recover ground water from the complex crystalline rocks of the Piedmont in northern Jones County are of two types. Wells of the first type, which furnish most of the rural ground water supplies, are the shallow dug wells with large infiltration surfaces along which ground water may percolate from the weathered upper part of the crystalline rocks and be recovered from the well. Wells of the second type, drilled wells, range from 2 to 6 inches in diameter, and from 60 to not more than

400 feet in depth. The drilled wells penetrate sufficient water-bearing fractures or joints in the crystalline rocks to produce ground water for small municipal, domestic, and livestock requirements.

Forsyth County also lies within the Piedmont physiographic province and receives its water from a series of metamorphic rocks. Metamorphic strata does not always yield the best chemical quality water.

Evaluation Methods

The study attempted to establish an estimate of the number of persons affected by "Class III" water supplies in the State. In many cases, the number of persons actually served by such a supply is not a matter of record. In addition, the probability that water will be consumed differs between guests at a motel and visitors at a day facility such as a recreation park. Nevertheless, visitors to both facilities are dependent upon the water served as the only water available. All visitors were included, therefore, in defining the population at risk. Assumptions employed in obtaining the estimated population at risk are included at the end of this Appendix.

Presented in Table I are the principle features of the Class III water systems surveyed in the three-county area. This tabulation includes information on the number of people served, treatment provided, surveillance by health agency, source, quality of water produced and the overall acceptability of the system from the public health standpoint. Judgement was necessary to rate the adequacy of treatment and freedom from sanitary defects. Emphasis in rating the systems was placed upon results of bacteriological testing and presence of chlorinating equipment and chlorine residual. Sufficient evidence was not assembled to evaluate adequately whether or not any particular system could operate safely without disinfection. In this report, therefore, systems not demonstrating evidence of continuous disinfection were not rated fully satisfactory. A system considered satisfactory in other respects except for the absence of chlorine equipment or chlorine residual was considered "questionable". If satisfactory public health protection is to be maintained, the Georgia State Department of Natural Resources should enforce its regulation requiring disinfection of all public water systems. The Environmental Protection Agency also endorses disinfection of all public water systems.

Seventeen supplies operated by the U.S. Army Corps of Engineers were surveyed in Forsyth County and included in Table I. All of these supplies failed to meet at least one of the recommended (esthetic) constituent limits of the Federal Drinking Water Standard, and six failed one or more mandatory (health) limits. The Standards state that the presence of constituents in excess of the mandatory limits is cause for rejection of the supply. These supplies are located at recreation sites around Lake Sydney Lanier, a Corps of Engineer Reservoir and serve no permanent resident population. Sampling was conducted in February which is a low use period for these recreation areas. In addition, the groundwater of this area is known to be corrosive and the unusually large amounts of metals in these wells was not found in other nearby wells with different use patterns. For these reasons, re-sampling of these supplies was indicated. Results of this re-sampling are pending, and supplies were rated "questionable" pending confirmation of the results. If re-sampling confirms toxic metals exceeding mandatory standards, supplies should be rated "unsatisfactory". In any case, the absence of disinfection requires that these supplies be rated "questionable".

Conclusions

1. In accordance with data obtained during the study, an estimated 4,200 Class III water systems are operating in Georgia. An estimated 29 million persons are annually dependent in one or more instances on a Class III water system for drinking water, although estimation methods may repeatedly count an individual if he is exposed to more than one Class III supply. This number compares reasonably with 50.7 million annual automobile travelers estimated by the Georgia Department of Industry and Trade. This significant number of persons who are or may be affected by the quality of the water requires that a stronger program for supervision of these supplies be established.

2. Of the 81 Class III water supplies surveyed and sampled, a significant percentage revealed the presence of bacterial or chemical contamination.

    (a) Sixteen (16) percent showed the presence of coliform organisms. Twelve (12) percent failed the bacteriological standard and 10 percent showed the presence of fecal coliform organisms. The systems failing the bacteriological standard serve an estimated 19,000 people annually.

(b) Twenty-seven (27) systems (33%) failed the recommended (esthetic) chemical standards and six systems (7%) failed to meet the mandatory (health) chemical limits. Re-sampling of these six supplies to confirm results has been accomplished and results are pending. Until re-sampling results are available, conclusions should be considered tentative. Approximately 222,373 persons annually are provided esthetically deficient water and 58,033 persons may be exposed to water failing health standards.

3. Only 6 percent of the Class III water systems surveyed and sampled could be given an overall "satisfactory" rating.

4. Twenty-seven (27) percent of the systems surveyed had not been visited by a health agency official in the previous two years. In most cases, the visit consisted of collection of a water sample and did not include significant inspection of facilities or operational practices. Most health agency surveillance was provided by county sanitarians who are not fully trained in maintenance and operation of water treatment facilities.

Recommendations

1. Enforce mandatory disinfection of all water systems serving the public.

2. Provide for inspections of facilities and operations at least annually and for initial plan review and approval. Also, provide a bacteriological sampling program requiring submission of at least two samples monthly for all systems serving the public.

3. Enforce minimum standards for construction, protection of source, size and type storage facility, disinfection equipment and distribution system.

4. Include all systems serving the public under present and future public water supply programs.

5. Immediately resample systems that contain impurities in concentrations exceeding mandatory limits which may be hazardous to the health of the consumers. If impurities exceeding mandatory limits are confirmed, public use of the water should be prohibited.

6. Provide supplementary training in small water system technology and public health protection for all county sanitarians or others who are involved in official public agency surveillance of Class III supplies.

Assumptions for Calculating Annual Population at Risk

1. Tourist and truck stop restaurants operate 300 days per year. Daily customers average six times seating capacity and customers average four visits per year.

2. Motels operate 180 days a year at 60 percent capacity. The average customer (3 people) stay two days. (All motels in study were tourist-oriented.)

3. Church camps and similar institutions operate eight sessions annually at 80 percent capacity.

4. Trailer parks and subdivisions risk only residents.

5. Lunch counters are open 300 days per year. Customers average four times seating capacity and average 40 visits per year.

6. Family campgrounds and travel trailer parks operate 120 days per year at 50 percent of capacity. Average length of stay is three days per family with an average of four (4) visitors per family.

7. Club houses are occupied to capacity five times per year.

8. Golf courses and airports operate 300 days per year. Customers return an average of 10 times per year.

9. Marinas, lakes and roadside parks operate 365 days per year. Customers return an average of 4 times per year.

10. Service stations operate 365 days per year. Customers average (3) three per automobile and return an average of (3) times per year.

Estimated Annual Population at Risk

	Class III Supplies		Estimate Annual Pop.	Average Annual Pop. per Supply
Cook County	18		213,559	
Jones County	21		26,667	6,753
Forsyth County	42		306,811	
	3)81= Av. 27	Tot.	547,037	

The total estimated annual population at risk for the three counties was divided by the number of supplies surveyed, thus giving the average annual population per supply.

One hundred fifty-nine (159) counties with 27 systems serving 6,753 persons annually yield 28,990,629 persons whose health may be affected by Class III water systems each year.

TABLE I - SUMMARY OF PRINCIPLE FEATURES OF SUPPLIES SURVEYED

COOK COUNTY SUPPLY	POPULATION SERVED		SOURCE			TREATMENT			SURVEILLANCE	QUALITY			RATING		
	Est. Daily Pop. at Risk	Est. Annual Pop. at Risk	Adeq. Qty.	Type	Free From Visible Sanitary Defect	Equip. to Chlor.	Chlor. Resid. Detect.	Addit. Treat.	Health Agcy. Visit In Prev. 2 Yrs.	MPN Total Coli.	MPN Fecal Coli.	Chem.	Satis.	Ques.	Unsatis.
A & A Drive Inn	120	900	Yes	W-30'	No	No	0	-	Yes	0	0	Fe-1.85		X	
Arrowhead Camp Ground	324	12,960	Yes	W-275'	Yes	No	0	-	Yes	5.1	0	OK			X
B. P. Service Station	150	18,250	Yes	W-300'	Yes	Yes	.2	-	No	0	0	OK	X		
Barneyville Sunoco Station	75	9,125	Yes	W-100'	No	No	0	-	Yes	0	0	Fe-1.19		X	
Country Club Circle	75	2,250	Yes	W-275'	Yes	No	0	-	Yes	0	0	OK		X	
Gibbs American Station	150	18,250	Yes	W-250'	Yes	No	0	-	Yes	0	0	OK		X	
Gulf Oil I-75	200	24,333	Yes	W-46'	Yes	No	0	-	Yes	0	0	OK		X	
Hank's Standard Station	210	25,550	Yes	W-260'	Yes	Yes	.3	-	Yes	0	0	OK	X		
Hayes American Oil	120	14,600	Yes	W-165'	Yes	No	0	-	Yes	0	0	OK		X	
Holiday Inn	160	8,640	Yes	W-450'	Yes	Yes	0	-	Yes	0	0	OK		X	
Rest Area #5	188	17,155	Yes	W-325'	Yes	Yes	.2	-	Yes	0	0	OK	X		
Rest Area #6	188	17,155	Yes	W-365'	Yes	Yes	.3	-	Yes	0	0	OK	X		
Safari Camp	40	1,600	Yes	W-285'	Yes	Yes	0	-	Yes	0	0	OK		X	
Skyline Service Station	150	18,250	Yes	W-273'	Yes	No	0	-	Yes	0	0	OK		X	
Stuckey's	191	17,428	Yes	W-250'	Yes	Yes	0	-	Yes	0	0	OK		X	
Swift 76 Station	50	6,083	Yes	W-320'	Yes	No	0	-	No	0	0	OK		X	
Tillman Trailer Park	30	30	No	W-300'	Yes	Yes	0	-	Yes	>16	0	OK			X
VFW Post Club	200	1,000	Yes	W-45'	Yes	No	0	-	Yes	0	0	OK		X	
TOTAL	2,621	213,559													

TABLE I - SUMMARY OF PRINCIPLE FEATURES OF SUPPLIES SURVEYED

JONES COUNTY SUPPLY	POPULATION SERVED		SOURCE			TREATMENT			SURVEILLANCE	QUALITY			RATING		
	Est. Daily Pop. at Risk	Est. Annual Pop. at Risk	Adeq. Qty.	Type	Free From Visible Sanitary Defect	Equip. to Chlor.	Chlor. Resid. Detect.	Addit. Treat.	Health Agcy. Visit In Prev. 2 Yrs.	MPN Total Coli.	MPN Fecal Coli.	Chem.	Satis.	Ques.	Unsatis.
Andrews Trailer Park	72	72	Yes	W-110'	Yes	No	No	-	Yes	0	0	OK		X	
Bass Trailer Park	18	18	Yes	W-265'	Yes	No	No	-	Yes	0	0	OK		X	
Beck's Trailer Park	40	40	Yes	W-150'	Yes	No	No	-	Yes	0	0	OK		X	
Camp Willis	50	320	Yes	W-100'	Yes	No	No	-	No	0	0	OK		X	
Clayton Kitchens	40	40	Yes	W-243'	Yes	No	No	-	Yes	0	0	OK		X	
Cleo's Restaurant	600	4,500	Yes	W-112'	Yes	No	No	-	Yes	0	0	OK		X	
Green's Trailer Park	70	70	Yes	3W-383'	Yes	No	No	-	Yes	0	0	Mn-.23 Fe-.42		X	
Hodges Trailer Park	36	36	Yes	W-236'	Yes	No	No	-	Yes	0	0	Mn-.32 Fe-.87		X	
J & G Truck Stop	240	18,000	Yes	W-94'	Yes	No	No	-	No	0	0	OK		X	
Jolie Bis Trailer Park	41	41	Yes	Sp-12'	Yes	No	No	-	Yes	0	0	OK		X	
Lake Jonesco Golf	35	1,050	Yes	W-70'	Yes	No	No	-	No	>16	9.2	OK			X
Lite N Tie	39	39	Yes	W-425'	Yes	No	No	-	Yes	0	0	OK		X	
Lynn Haven Nursing Home	40	40	Yes	2W-240'	Yes	No	No	-	No	0	0	OK		X	
Martin Marietta Quarry	70	70	No	W-165'	Yes	No	No	-	No	0	0	Zn-6.3 Fe-.75		X	
Old Clinton Bar-B-Q	120	900	Yes	2W-62'	Yes	No	No	-	No	5.2	0	OK			X
Star Motel	24	1,260	Yes	W-300'	Yes	No	No	-	No	0	0	OK		X	
Three Oaks Nursing	40	40	Yes	W-225'	Yes	No	No	-	Yes	0	0	Iron		X	
Walker Farm	12	12	Yes	W-27'	No	No	No	-	Yes	>16	0	OK			X
Walker Spring	62	62	No	Sp-7'	No	No	No	-	Yes	0	0	Fe-1.60		X	
Walker Trailer Park	15	15	No	Sp-5'	No	No	No	-	Yes	9.2	9.2	Fe-2.00			X
Walker Well	42	42	Yes	W-30'	Yes	No	No	-	Yes	>16	16	Fe-.90			X
TOTAL	1,706	26,667													

TABLE I - SUMMARY OF PRINCIPLE FEATURES OF SUPPLIES SURVEYED

FORSYTH COUNTY SUPPLY	POPULATION SERVED		SOURCE			TREATMENT			SURVEILLANCE	QUALITY			RATING		
	Est. Daily Pop. at Risk	Est. Annual Pop. at Risk	Adeq. Qty.	Type	Free From Visible Sanitary Defect	Equip to Chlor.	Chlor. Resid. Detect.	Addit. Treat.	Health Agcy. Visit In Prev. 2 Yrs.	MPN Total Coli.	MPN Fecal Coli.	Chem.	Satis.	Ques.	Unsatis.
Bagwell Trailer Park	12	12	Yes	W-55'	No	No	0	-	No	0	0	OK		X	
Coal Mt. Trailer Park	15	15	Yes	W-35'	Yes	No	0	-	No	0	0	OK		X	
Cook's Barbecue	300	2,250	Unk.	Well	No	No	0	-	No	0	0	OK		X	
Daisy Mae Drive Inn	140	1,050	Yes	W-250'	Yes	No	0	-	Yes	0	0	OK		X	
Dixion Trailer Park	60	60	Yes	W-250'	Yes	No	0	-	Yes	0	0	OK		X	
Ed Johnson-Bald Ridge Marina	234	21,352	Yes	W-300'	Yes	No	.9	-	No	0	0	OK	X		
Forsyth Co. Day Care Center	103	103	Yes	W-300'	Yes	No	0	-	Yes	0	0	OK		X	
Forsyth Co. Education Center	45	45	Yes	W-280'	Yes	No	0	-	Yes	0	0	OK		X	
Ga. Farmers Livestock, Inc.	125	9,375	Unk.	W-50	No	No	0	-	Yes	0	0	OK		X	
Green Market & Gas	50	5,116	Yes	W-50'	No	No	0	-	No	>16	>16	OK			X
Heard & Gravitt Tractor Co.	16	16	Yes	W-25'	Yes	No	0	-	No	2.2	0	OK			X
Jay's Mobile Home Park	66	66	Yes	W-230'	Yes	No	0	-	Yes	2.2	2.2	OK			X
Jeans Cabins	36	36	Yes	W-50'	No	No	0	-	No	0	0	OK		X	
Lanier Land Home Park	15	15	Yes	W-300'	Yes	No	0	-	No	0	0	OK		X	
Lan-Mar Marina	200	18,250	Yes	W-300'	Yes	No	0	-	Yes	0	0	OK		X	
Lantern Inn	191	14,325	Yes	W-365'	Yes	No	0	-	Yes	0	0	OK		X	
Manning Mobile Home	45	45	Yes	W-270'	Yes	No	0	-	Yes	0	0	Zn-5.6		X	
Mathis Airport	24	720	Yes	W-250'	No	No	0	-	No	0	0	OK		X	
Midway Self Service	100	12,166	Unk.	Well	No	No	0	-	Yes	>16	>16	OK			X
Pine Ranch Cafe	75	563	Unk.	Well	Unk.	No	0	-	Yes	>16	>16	OK			X
Prestige Apartments	60	60	Yes	W-275'	Yes	No	0	-	No	0	0	OK		X	
Raines Mobile Home Park	24	24	Yes	W-50'	No	No	0	-	No	0	0	OK		X	
Ralph Moore Trailer Park	14	14	Unk.	Well	No	No	0	-	No	>16	>16	OK			X
Shirley Dixion-Rest. & Grill	62	4,650	Yes	W-200'	Yes	No	0	-	Unk.	0	0	OK		X	
Steak & Barbecue Barn	60	4,500	Yes	W-200'	Yes	No	0	-	Yes	0	0	OK		X	
Vaughn Tr. Ct. & Meat Produce	15	15	Yes	W-240'	Yes	No	0	-	Yes	0	0	OK		X	
Wesley Oaks Home Park	70	70	Yes	W-350'	Yes	No	0	-	No	0	0	Zn-13.0		X	
TOTAL	2,157	94,913													

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TABLE I - SUMMARY OF PRINCIPLE FEATURES OF SUPPLIES SURVEYED

FORSYTH COUNTY SUPPLY	POPULATION SERVED		SOURCE			TREATMENT			SURVEILLANCE	QUALITY			RATING		
	Est. Daily Pop. at Risk	Est. Annual Pop. at Risk	Adeq. Qty.	Type	Free From Visible Sanitary Defect	Equip. to Chlor.	Chlor. Resid. Detect.	Addit. Treat.	Health Agcy. Visit In Prev. 2 Yrs.	MPN Total Coli.	MPN Fecal Coli.	Chem.*	Satis.	Ques.	Unsatis.
CORPS OF ENGINEERS															
Baldridge Creek	47	4,288	Yes	Well	Yes	No	0	-	Yes	0	0	Mn-.051 Fe-.46		X	
Bethel Park	28	2,555	Yes	Well	Yes	No	0	-	Yes	0	0	Mn-.41 Fe-8.2 Zn-5.1		X	
Charleston Park	117	10,676	Yes	Well	Yes	No	0	-	Yes	0	0	Mn-.11 Fe-1.9		X	
Keith Bridge Well #34	206	18,797	Yes	Well	Yes	No	0	-	Yes	0	0	Mn-.14 Fe-3.2 Cd-.013 Zn-12.0		X	
Keith Bridge Well #35			Yes	Well	Yes	No	0	-	Yes	0	0	Mn-.051 Pb-.24 Fe-2.6 Zn-32.0		X	
Sawnee Park	535	48,848	Yes	Well	Yes	No	0	-	Yes	0	0	Mn-.28 Fe-3.9		X	
Shady Grove Well #41	91	8,303	Yes	Well	Yes	No	0	-	Yes	0	0	Mn-.48 Fe-10.0 Pb-.16 Cd-.083 Zn-29.0		X	
#42			Yes	Well	Yes	No	0	-	Yes	0	0	Mn-.075 Fe-2.8 Pb-.083 Cd-.019 Zn-33.0		X	
#43			Yes	Well	Yes	No	0	-	Yes	0	0	Mn-.41 Fe-53.0 Zn-10.0		X	
Six Mile Creek	270	24,637	Yes	Well	Yess	No	0	-	Yes	0	0	Pb-.082 Fe-3.9 Zn-14.0		X	

TABLE I - SUMMARY OF PRINCIPLE FEATURES OF SUPPLIES SURVEYED

FORSYTH COUNTY SUPPLY	POPULATION SERVED		SOURCE			TREATMENT			SURVEILLANCE	QUALITY			RATING		
	Est. Daily Pop. at Risk	Est. Annual Pop. at Risk	Adeq. Qty.	Type	Free From Visible Sanitary Defect	Equip. to Chlor.	Chlor. Resid. Detect.	Addit. Treat.	Health Agcy. Visit In Prev. 2 Yrs.	MPN Total Coli.	MPN Fecal Coli.	Chem.*	Satis.	Ques.	Unsatis.
CORPS OF ENGINEERS (Cont'd)															
Tidwell Park	164	14,965	Yes	Well	Yes	No	0	-	Yes	0	0	Mn-.039 Fe-1.5		X	
Two Mile Creek	170	15,603	Yes	Well	Yes	No	0	-	Yes	0	0	Mn-.080 Fe-3.3 Zn-8.0		X	
Vann's Taverns	51	4,653	Yes	Well	Yes	No	0	-	Yes	0	0	Mn-.26 Fe-.94 Zn-8.7		X	
War Hill Well #32	158	14,417	Yes	Well	Yes	No	0	-	Yes	0	0	Mn-.14 Fe-4.5 Zn-16.0		X	
War Hill Well #33			Yes	Well	Yes	No	0	-	Yes	0	0	Mn-.23 Fe-3.2 Zn-5.2		X	
West Bank Park	415	37,860	Yes	W-350'	Yes	Yes	0	-	Yes	0	0	Fe-9.4		X	
Young Deer Creek	69	6,296	Yes	Well	Yes	NO	0	-	Yes	0	0	Fe-1.92 Pb-.12 Zn-32.0		X	
TOTAL - Corps of Engr.	2,321	211,898													
GRAND TOTAL - Forsyth Co.	4,478	306,811													

*Mandatory Limits Concentration in mg/1

Pb - Lead 0.05
Cd - Cadmium - 0.01

APPENDIX C

Adequacy of The Water Fluoridation Control Program in Georgia

An Evaluation of Water Fluoridation At Selected Water Supply Systems In the State of Georgia

Thomas N. Hushower, P.E.
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Office of Water Programs Operations
Environmental Protection Agency

GEORGIA WATER SUPPLY PROGRAM EVALUATION

ADEQUACY OF THE WATER FLUORIDATION CONTROL PROGRAM IN GEORGIA

Introduction

The control of the fluoride ion level in the public water supplies in Georgia to within an optimum range of 0.7 - 1.2 mg/l is recommended by the State Board of Human Resources as an important public health measure for the prevention of tooth decay. The State Code, Section 88-2603, was recently amended to require the "fluoridation of potable public water supplies in incorporated communities lying wholly within this State." However, "any city or county and their water systems can remove themselves from the terms of this act by referendum...". The Act also requires the State to make available "funds for the cost of the fluoridation equipment, the installation of such equipment and the chemicals required for six months of fluoridation...".

The Environmental Protection Division in the State Department of Natural Resources is responsible for approval and surveillance of all public water supplies in Georgia including all fluoridation installations. Requirements for the control of the fluoridation process are included in the Rules and Regulations for Water Supply Quality Control, Chapter 27-5-15.

As of February 1, 1973, seventy-four public water supply systems (excluding military and communities served from the Chattanooga, Tennessee, water supply) out of a total of approximately 1900 public water supply systems in the State of Georgia were fluoridating. An estimated 2.2 million people or 68 percent of the population using public water supplies received fluoridated water. 1/ Seven communities were reported using one or more water sources containing natural fluorides of 0.7 mg/l or higher and one community, Siloam, was using one or more water sources containing natural fluorides of 3.5 mg/l fluoride. 2/

The proven benefits derived from fluoridation in dollars to prevent dental caries for the population in Georgia served by fluoridated water is estimated to be $20 million. The cost to the State for implementing the recommendations of this report is $50,000 and the cost to the local communities is estimated at $350,000 giving a benefit cost ratio to the State of 50 to 1. To receive full value of the benefits of fluoridation, it is essential that the fluoride levels be maintained between 0.9 - 1.1 mg/l as a reduction of only 0.2 mg/l below the optimum value (1.0 mg/l) will reduce the benefits of fluoridation by 50 percent.

1/ Fluoridation Census 1969 (Revised April 1972), U.S. Department of Health, Education, and Welfare, Public Health Service.

2/ Natural Fluoride Content of Community Water Supplies, 1969, U.S. Department of Health, Education, and Welfare, Public Health Service.

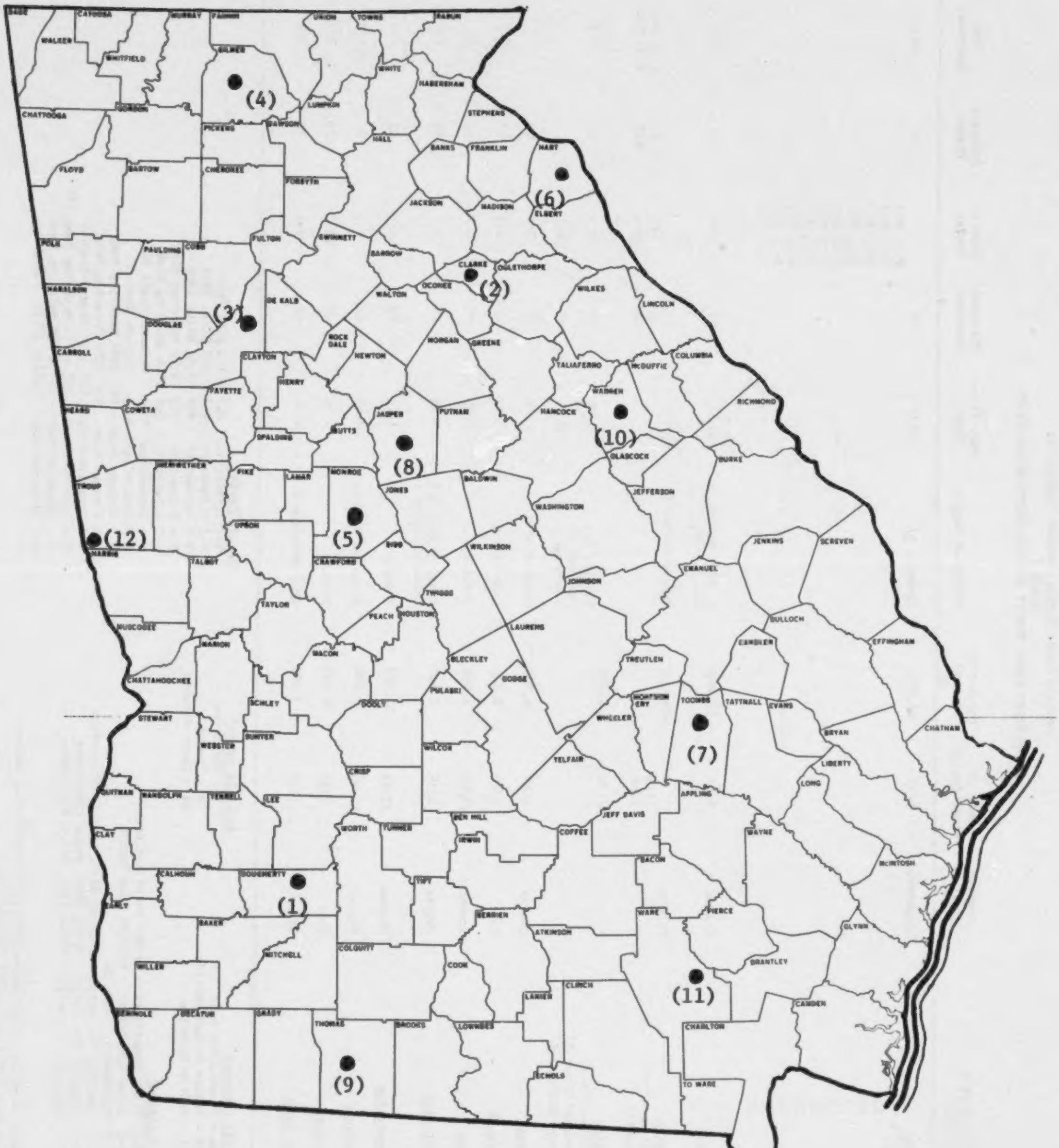
Evaluation Procedure

To evaluate the adequacy of the Georgia State Department of Natural Resources, Environmental Protection Division's water fluoridation control program, twelve fluoridated water supply systems were selected for survey. The choice of the twelve systems representative of the seventy-four fluoridation installations in Georgia was based on geographical location, population served, source of water supply (ground or surface water), and fluoride compound used in fluoridation. Figure 1, Fluoridated Water Supply Systems Selected For Study, locates the twelve installations visited and Table I summarizes pertinent information on each facility.

Georgia Water Supply Program Evaluation

Figure 1

FLUORIDATED WATER SUPPLY SYSTEMS SELECTED FOR STUDY



1 - Albany
2 - Athens
3 - Atlanta
4 - Ellijay
5 - Forsyth
6 - Hartwell
7 - Lyons
8 - Monticello
9 - Thomasville
10 - Warrenton
11 - Waycross
12 - West Point

Georgia Water Supply Program Evaluation
TABLE I
FLUORIDATED WATER SUPPLY SYSTEMS SELECTED FOR STUDY

Water Supply System	Location (County)	Date of Fluoridation	Population Served	Source of Supply	Avg. Flow (MGD)	Fluoride Compound	Type of Feeder	Analysis Method	Test Equipment
Albany	Dougherty	9/53	65,000	20-Wells 1/	13.0	VS		S	T-3
Well # 8							V-1, P-1		
11							V-1, P-1		
14							V-2, P-3		
17							V-1, P-2		
18							V-2, P-3		
19							V-2, P-3		
22							V-2, P-3		
23							V-2, P-3		
24							V-2, P-3		
25							V-2, P-3		
Athens	Clarke	5/51	60,000	N. Fork Oconee R. Sandy Creek	11.0	VT	V-2	SS	T-1
Atlanta	Fulton		650,000	Chattahoochee R.	103.0				
Chattahoochee		2/69				VA	P-5	E	T-5, T-4
Hemphill		7/69				VA	P-6	S,E	T-3, T-6
Ellijay		2/71	2,000						
Ellijay River				Ellijay R.	1.00	VT	V-1	S	T-3
Cartegay River 2/				Cartegay R.	0.33				
Joyce Springs 3/				4-Springs	0.23	VT	V-1		
Forsyth	Monroe	6/57	8,000	Tobosofkee Cr.	0.75	VT	V-1	SS	T-2
Hartwell	Hart	7/65	8,000	Lake Hartwell	1.0	VS	V-3	SS	T-2
Lyons	Toombs	10/69	4,000	3-Wells	0.25	VS	V-2, P-4	4/	4/
Monticello	Jasper	5/59	2,500	Popes Branch and Nelsons Branch	0.35	VS	V-1	SS	T-2
Thomasville	Thomas	11/54	22,000	5-Wells	3.20	VS	V-4	SS	T-2
Warrenton	Warren	12/70	2,600	Rocky Comfort Cr.	0.19	VA	P-7	S	T-3
Waycross	Ware	1/55	18,000	3-Wells	2.25	VT	PS-1	SS	T-2
West Point	Troup	4/57	5,000	Chattahoochee R.	0.66	VS	V-5	SS	T-2

Fluoride Compound
VA - Fluosilicic Acid
VS - Sodium Silicofluoride
VT - Sodium Fluoride

Analysis Method
E - Electrode
S - Spadns
SS - Scott-Sanchis

Type of Feeder
V-1 Volumetric - W&T A-378 Roll Type
V-2 Volumetric - W&T A-690 Screw Type
V-3 Volumetric - BIF 25-04 Helix Type
V-4 Volumetric - BIF 23-02 Rotating Disk
V-5 Volumetric - BIF 50-A Rotating Disk
P-1 Centrifugal Pump - Weinman Model IG
P-2 Centrifugal Pump - Century Type SC
P-3 Plunger Pump - W&T 200A Metering Pump
P-4 Plunger Pump - W&T 150A Metering Pump
P-5 Diaphram Pump - BIF 1210 Chem-O-Feeder
P-6 Diaphram Pump - W&T A-747 Metering Pump (2)
P-7 Diaphram Pump - W&T A-588 Metering Pump
PS-1 Diaphram Pump - Madden #6252, Saturator

Test Equipment
T-1 Color Comparator - Taylor Water Analyzer
T-2 Color Comparator - Hellige Aqua Tester
T-3 Photometer - Hach DR
T-4 Specific Ion Meter - Corning #619, Corning Electrodes
T-5 Specific Ion Meter - Orion #401, Orion Electrodes
T-6 Specific Ion Meter - Orion #407, Orion Electrodes

1/ Only 10 Wells in Operation and Fluoridated During Survey
2/ Cartegay River Source Not Fluoridated
3/ Fluoridation Discontinued November 1972 - Malfunctioning Timer
4/ No Fluoride Analysis Conducted by Operator

The survey of the twelve representative fluoridation installations included a field inspection visit to the facility (the State notified the operators of the visit in advance), completion of a survey form 3/, and collection of water samples for fluoride ion analysis. Each installation was examined with respect to: fluoride ion content in the distribution system; analytical control of the fluoride ion level (records kept); fluoride chemical feed equipment and facilities; fluoride chemical compound storage and handling; operator training and interest; and, surveillance.

The actual level of fluoride ion in the distribution system is the single most important factor in evaluating the adequacy of a community water fluoridation effort and hence in evaluation of the State program responsible for approval and surveillance of the installation. However, as distribution samples collected on one particular day may not give a true picture of day-to-day operating conditions, the installations were also evaluated with respect to the following:

I. Analytical Control of the Fluoride Ion Level

   A. Were the fluoride ion analyses conducted at the water plant accurate within ± 0.1 mg/l of the value determined by the Environmental Protection Agency?

3/ A copy of the questionnaire used in the Georgia Fluoridation Survey is appended.

B. Were finished water samples analyzed daily or more frequently for fluoride ion content?

C. Were raw water samples analyzed regularly for fluoride ion content?

D. Were laboratory equipment and facilities at the water plant adequate to conduct fluoride ion analysis according to one of the three standard methods?

E. Was laboratory equipment clean and given responsible care?

F. Were complete records kept of the fluoridation operation?

II. Fluoride Chemical Feed Equipment and Facilities

A. Were the fluoride feed equipment and facilities adequate to control the fluoride ion level in the finished water?

B. Was positive protection provided against overfeeding? Was backflow protection provided? Was equipment location and point of fluoride chemical application at the best practical site? Was the feed equipment site uncluttered?

C. Was the fluoride chemical feed installation operated continuously for the past twelve months without an interruption of more than one day?

D. Were the fluoride chemical feed equipment and facilities maintained satisfactorily?

III. Fluoride Chemical Compound - Storage and Handling

A. Was the fluoride chemical compound stored in a safe, protected and orderly manner?

B. Was safety equipment available and were safe procedures followed in handling the fluoride chemical compound?

C. Were fluoride chemical shipping containers disposed of satisfactorily or re-used only for fluoride chemical storage?

IV. Operator Training and Interest

A. Were plant operating personnel well-trained to operate the fluoride chemical feed equipment and facilities?

B. Were personnel conducting the fluoride ion analyses knowledgeable of their test equipment and standard procedures for analysis?

C. Was the water plant official interviewed in favor of fluoridation and was he interested in adding fluorides to public water supply systems?

V. Surveillance

A. Were check samples for fluoride ion analysis submitted to the state as required?

B. Had the water fluoridation installation surveyed been inspected in the past twelve months by a representative of the state water supply program surveillance agency?

Summary of Findings

Data collected on the water supply systems fluoridating in the State of Georgia indicated nine (75 percent) of the twelve installations selected for investigation evidenced a fluoride ion content in the distribution system at the time of the survey within the 0.7 - 1.2 mg/l range recommended by the State Department of Natural Resources. Two (17 percent) of the facilities were underfeeding, i.e. the fluoride ion level in the samples collected from the distribution system were less than 0.7 mg/l and two were overfeeding. Water samples collected from one system (Albany) were both below and above the recommended fluoride ion level. Table II, Analysis of Samples From Fluoridated Water Supply Systems, tabulates the fluoride ion analysis of the water samples collected at each facility surveyed 4/.

The operating conditions observed during the time of the survey of the twelve fluoridation installations inspected are summarized as follows:

I. Analytical Control of the Fluoride Ion Level

Practices to analytically test and control the fluoride ion level in the distribution systems varied considerably. Only five (45 percent) of the plant operators or laboratory personnel testing water samples for fluoride ion content conducted the

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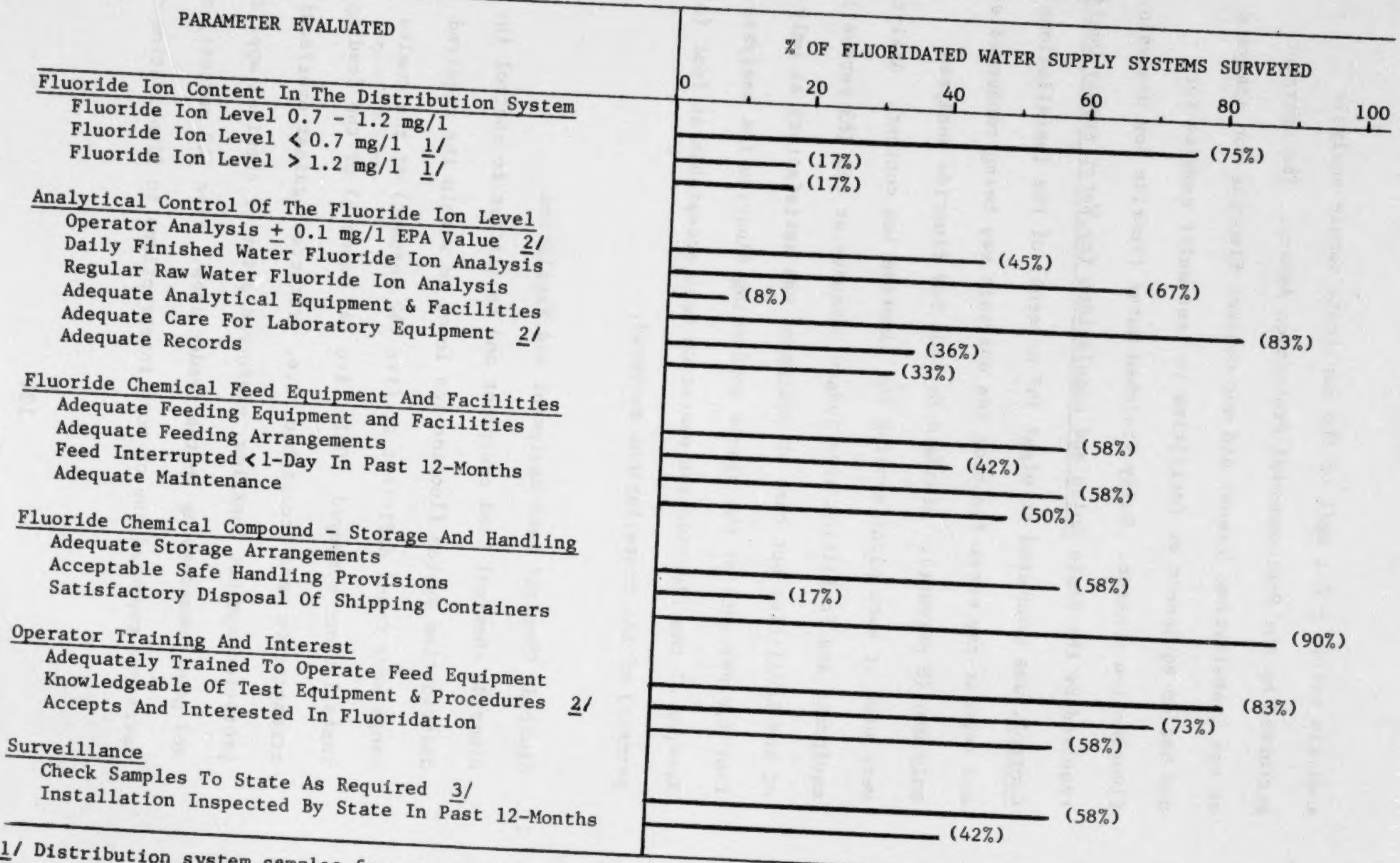
4/ Water samples were analyzed for fluoride ion content by the Water Supply Division, Environemntal Protection Agency, Washington, D. C. using the Electrode Method.

GEORGIA WATER SUPPLY PROGRAM EVALUATION

FIGURE 2

OPERATING CONDITIONS AT SELECTED FLUORIDATED WATER SUPPLY SYSTEMS



1/ Distribution system samples from one system were both above and below the 0.7 - 1.2 mg/1 fluoride range.

2/ Eleven systems rated. The operator at one installation did not conduct fluoride ion analysis.

3/ Per 1972 Georgia Dept. of Public Health, Water Supply Laboratory Records - 3 per month.

analysis within ± 0.1 mg/l of the duplicate sample analysis performed by the Environmental Protection Agency. The operator at one installation (Lyons) did not conduct fluoride ion analysis and had no equipment or facilities to test water samples for fluoride ion content. Daily finished water fluoride ion analysis, required by the State Rules and Regulations for Water Supply Quality Control, was conducted at eight (67 percent) of the installations and regular raw water fluoride ion analysis was being conducted at only one (8 percent). Standard Methods for fluoride analyses were used at each plant testing for fluoride ion content. Analytical equipment and facilities were judged adequate at ten (83 percent) of the facilities but care of equipment was satisfactory at only four (36 percent) of the plants conducting fluoride ion analyses. Records of the fluoridation operation were acceptable at four (33 percent) of the installations surveyed.

II. Fluoride Chemical Feed Equipment and Facilities

Fluoride chemical feed equipment and facilities to control the distribution system fluoride ion level to within the required range were found deficient at five (42 percent) of the twelve installations surveyed. Only five (42 percent) of the feeding arrangements were acceptable, i.e. protected against overfeeding, protected against backflow, preferred point of chemical application, and good housekeeping in the feeder area. Five (42 percent) of the operators reported one or more interruptions in fluoridation of one or more days duration in the past twelve months. Maintenance was found satisfactory at only six (50 percent) of the facilities surveyed, even though the plant operators had been alerted to the inspection visit.

III. Fluoride Chemical Compound - Storage and Handling

Storage arrangements for the fluoride chemical compound fed were unsatisfactory at five (42 percent) of the twelve installations surveyed. Ten (83 percent) of the operators interviewed did not have available suitable safety equipment to handle the fluoride chemical compounds; and one (10 percent) of the operators was not disposing of the empty chemical shipping containers satisfactorily.

IV. Operator Training and Interest

A trained operator with a genuine interest in feeding fluorides is essential to the satisfactory operation of a fluoridation installation. Two (17 percent) of the facilities surveyed were operated by personnel not completely familar with the fluoride chemical feed equipment at their plants. Three (27 percent) of the operators questioned were not adequately trained in the use of the fluoride ion test equipment provided and the procedures to follow in conducting fluoride ion analyses. The operators at five (42 percent) of the plants visited did not favor feeding fluorides to public water supply systems.

V. Surveillance

Frequent check samples of fluoride ion levels in the distribution system and regular inspection visits to the water fluoridation installation by State water supply surveillance personnel must be conducted to assure the facility is operating satisfactorily. The State Department of Natural Resources requires three water samples per month to be collected from the distribution system of fluoridated water supplies and submitted to the State Laboratory for fluoride ion analysis. A review of State Laboratory records for 1972 revealed the required number of check samples had not been received from five (42 percent) of the installations selected for survey. Only five (42 percent) of the twelve plants had been visited in the past twelve months by a representative of the State water supply surveillance agency. Inspection visits to the water supply systems surveyed averaged one visit in twenty months.

Figure 2, Operating Conditions At Selected Fluoridated Water Supply Systems, summarizes the operating conditions observed at the installations inspected during the time of the survey. Conditions varied at each facility and Table III, Adequacy Of Fluoridation At Selected Fluoridated Water Supply Systems, summarizes the adequacy of the operating conditions at each facility during the time of the survey.

GEORGIA WATER SUPPLY PROGRAM EVALUATION
TABLE II
ANALYSIS OF SAMPLES FROM SELECTED FLUORIDATED WATER SUPPLY SYSTEMS

		Fluoride, mg/l				
			Check Sample			
Water Supply System	Date of Sample	Raw Water	(Operator)	(EPA)	Distribution System	
Albany 1/	3/8		0.75	0.58	0.91	0.80
					0.67	0.80
Well # 8		0.22			0.75	
11		0.21			1.02	
14		0.21			0.92	
17					1.95	
18		0.35			0.86	
19		0.18			0.68	
22					0.83	
23					0.67	
24					0.85	
25					0.70	
Athens	2/13	0.07	0.9	1.05	1.07	1.05
					1.02	
Atlanta	3/5	0.10				
Chattahoochee			0.91	0.92	0.72	0.75
Hemphill			0.9	0.75	0.75	0.70
					0.71	
Ellijay	2/14					
Ellijay River		0.05	0.7	0.64	0.98	
Cartegay River 2/					0.35	
Joyce Springs 3/					0.31	
Forsyth	3/9	0.10	0.9	0.86	0.90	0.91
Hartwell	2/12	0.06	1.2	1.25	1.25	1.35
Lyons	3/6		4/		0.78	0.81
					0.80	
Monticello	2/15	0.07	0.7	0.77	1.03	0.83
					0.82	
Thomasville 5/	3/7		0.75	0.98	1.05	1.02
					1.03	
Well #3		0.46				
4		0.45				
5		0.50				
6		0.45				
Warrenton	3/6	0.08	1.0	0.80	0.78	0.82
Waycross	3/7		0.9	1.08	1.14	1.03
					1.14	1.06
Legion Park Well		0.50				
Annex Well		0.48				
Reservoir Well		0.45				
West Point	2/16	0.10	0.9	0.82	0.86	0.87

1/ Only 10 of 20 Wells in Operation and Fluoridated during Survey
2/ Cartegay River Source Not Fluoridated
3/ Fluoridation Operation Discontinued November 1972 - Malfunctioning Timer
4/ No Fluoride Analysis Conducted by Operator
5/ Only 4 of 5 Wells Used Regularly

GEORGIA WATER SUPPLY PROGRAM EVALUATION
TABLE III
ADEQUACY OF FLUORIDATION AT SELECTED WATER SUPPLY SYSTEMS

PARAMETER EVALUATED	Albany	Athens	Atlanta	Ellijay	Forsyth	Hartwell	Lyons	Monticello	Thomasville	Warrenton	Waycross	West Point
Fluoride Ion Content In The Distribution System												
Fluoride Ion Level 0.7 - 1.2 mg/l	X	O	O	X	O	X	O	O	O	O	O	O
Fluoride Ion Level < 0.7 mg/l	X			X								
Fluoride Ion Level > 1.2 mg/l	X					X						
Analytical Control Of The Fluoride Ion Level												
Operator Analysis ± 0.1 mg/l EPA Value	X	X	X	O	O	O	3/	O	X	X	X	O
Daily Finished Water Fluoride Ion Analysis	X	O	O	X	X	O	X	O	O	O	O	O
Regular Raw Water Fluoride Ion Analysis	X	X	X	X	X	X	X	O	X	X	X	X
Adequate Analytical Equipment & Facilities	O	X	O	O	O	O	X	O	O	O	O	O
Adequate Care For Laboratory Equipment	X	X	O	X	X	O	N/A	X	O	X	X	O
Adequate Records	O	O	O	X	X	X	X	X	X	X	X	O
Fluoride Chemical Feed Equipment And Facilities												
Adequate Feeding Equipment and Facilities	O	X	O	X	X	O	O	X	O	O	X	O
Adequate Feeding Arrangements	X	O	O	X	X	O	X	O	X	O	X	X
Feed Interrupted < 1-Day In Past 12-Months	X	O	X	X	O	X	O	O	X	O	O	O
Adequate Maintenance	X	O	O	X	X	X	X	X	O	O	O	O
Fluoride Chemical Compound - Storage And Handling												
Adequate Storage Arrangements	O	X	O	X	X	O	O	X	O	O	X	O
Acceptable Safe Handling Provisions	X	O	O	X	X	X	X	X	X	X	X	X
Satisfactory Disposal Of Shipping Containers	O	O	N/A	O	O	O	O	O	O	N/A	X	O
Operator Training And Interest												
Adequately Trained To Operate Feed Equipment	O	O	O	X	O	O	X	O	O	O	O	O
Knowledgeable Of Test Equipment & Procedures	X	O	O	X	O	O	N/A	O	O	X	O	O
Accepts And Interested In Fluoridation	O	O	X	X	O	O	X	O	X	O	X	O
Surveillance												
Check Samples To State As Required 1/	X	X	O	X	O	O	X	O	X	O	O	O
Installation Inspected By State In Past 12-Months	X	X	O	O	O	X	X	X	O	X	O	X

O - Satisfactory or Applicable for System Surveyed, X - Unsatisfactory
N/A - Not Applicable
1/ - Per 1972 Georgia Dept. of Public Health, Water Supply Laboratory Records - 3 per Month
2/ - Distribution System Samples Were Both Above and Below the 0.7 - 1.2 mg/l Fluoride Range
3/ - No Fluoride Analysis Conducted by Operator

Conclusions and Recommendations

1. Seventy-four public water supply systems in the State of Georgia were fluoridating February 1, 1973, (excluding military and communities served from the Chattanooga, Tennessee water supply). An estimated 2.2 million or 68 percent of the population using public water supplies received fluoridated water. The State Code was recently amended to require the fluoridation of all potable public water supplies in incorporated communities in Georgia.

   ### Recommendation

   The State Department of Natural Resources, Environmental Protection Division, should implement the provision of the new fluoridation legislation as soon as possible to provide the benefits of fluoridated water to the population (32 percent) in the State served by public water supplies which are not fluoridated or do not contain dentally significant concentrations of fluorides.

2. The community of Siloam, Georgia was reported to be using one or more water sources containing natural fluorides of 3.5 mg/l.

Recommendations

When the natural fluoride ion level in a public water supply exceeds two times the optimum the following should be considered so the finished water will have a fluoride ion level within the limits required by the State: blending of water containing high levels of fluoride ion with a low natural fluoride water, development of an alternate source of water, or defluoridation of the water source.

3. Nine (75 percent) of the twelve fluoridated water supply systems surveyed evidenced a fluoride ion content in the distribution system within the limits required by the State Department of Natural Resources. Only five (45 percent) of the plant operators or laboratory personnel testing water samples for fluoride ion content conducted the analysis within ± 0.1 mg/1 of the sample results analyzed by the Environmental Protection Agency. Daily finished water fluoride ion analysis required by the State Rules and Regulations for Water Supply Quality Control was conducted at eight (67 percent) of the installations and the source of raw water was analyzed on a regular basis at only one (8 percent) of the facilities surveyed. Records of the fluoridation operation were acceptable at only four (33 percent) of the plants.

Recommendation

The State Department of Natural Resources should require the operators at all fluoridation installations to conduct fluoride ion analysis according to Standard Methods to within ± 0.1 mg/l of the value reported on the State check sample. Daily finished water fluoride ion analysis, regular raw water fluoride ion analysis, adequate laboratory equipment and care of equipment, and complete records on the fluoridation operation should be enforced at all fluoridation installations.

4. Fluoride chemical feed equipment and facilities were satisfactory at seven (58 percent) of the installations surveyed. Feeding arrangements were judged adequate at only five (42 percent). Five (42 percent) of the installations had one or more interruptions in the fluoridation operation of one or more days duration in the past twelve months and maintenance was less than satisfactory at six (50 percent) of the facilities visited even though each operator had been alerted to the inspection visit.

Recommendation

The State Department of Natural Resources should provide design criteria to all communities installing fluoridation equipment, thoroughly review all proposed installations before the operation is approved, and assist the operator as needed during the "start-up" period. All interruptions in the fluoridation operations should be required to be reported to the Environmental Protection Division of the State Department of Natural Resources. A preventative maintenance program should be established for each facility and closely followed for the installation to receive continued approval for operation.

5. Fluoride chemical storage arrangements were judged inadequate at five (42 percent) of the installations surveyed. Ten (83 percent) of the operators did not have available suitable safety equipment to handle the fluoride chemical compounds used and one (10 percent) of the operators was not disposing of the empty chemical shipping containers in a satisfactory manner.

   Recommendation

   The State Department of Natural Resources should instruct all water plant operators feeding fluorides on safe storage and handling practices for fluoride chemical compounds and promulgate regulations for storage and handling fluoride chemical compounds used in water fluoridation in the State of Georgia.

6. A trained operator with a genuine interest in feeding fluorides is essential to the satisfactory operation of a fluoridation installation. Training deficiencies were noted in the operators knowledge of his fluoride feed equipment and his acquaintance with the equipment and procedures used in conducting fluoride ion analysis. Five (42 percent) of the operators interviewed did not favor feeding fluorides to public water supply systems.

   Recommendation

   The State Department of Natural Resources should provide training in fluoride feed equipment operation and maintenance and fluoride determinations in water for the operators of all fluoridated water supply systems. The benefits of water fluoridation and the importance of maintaining an optimum level of fluoride ion in the distribution system at all times should be stressed. Satisfactory completion of the course should be a mandatory requirement of the plant operator for approval of his installation to feed fluorides.

7. Surveillance of each water fluoridation installation must be on a regular, continual basis to assure the facility is operating satisfactory. Five (42 percent) of the operators interviewed were not submitting the required number of check samples to the State laboratory for fluoride ion analysis. Seven (58 percent) of the installations had not been visited by a representative of the State water supply surveillance agency or local health department in the past twelve months.

Recommendation

The State Department of Natural Resources should enforce their policy requiring three menthly check samples to be collected from the distribution systems of fluoridated water supplies and sent to the State Laboratory for fluoride ion analysis. All interruptions in the fluoridation operations should be investigated by the Environmental Protection Division and all plants employing new operating personnel placed in charge of the fluoridation operation should be visited immediately to assure the new operator has been adequately trained. One additional full time engineer with the necessary travel funds and laboratory support is estimated to be needed for an adequate fluoridation surveillance program in the State of Georgia.

DATE:____________

GEORGIA FLUORIDATION SURVEY

Water System:

Population Served: **Average Flow:**

Date Fluoridation Started:

Source of Supply:

Treatment:

Fluoride Analysis:
Raw Water: **Finished Water:**

Fluoridation Equipment -

Manufacturer:

Type:

Model:

Location:

Point of Application:

Condition of Equipment:

Operational Problems:

Overfeeding Safeguards:

Planned Improvements:

Remarks:

Fluoride Compound -

Chemical: Cost:

Source:

Form of Shipment

Storage Facilities:

Quantity Used:

Safety Provisions:

Disposal of Containers:

Remarks:

Control of Fluoridation -

Frequency of Sampling:
Raw Water: Finished Water:

Sampling Point:

Test Method:

Test Instrument:
Adequacy

Condition

Records:
Calculated

Lab

Interruptions:

Remarks:

Operator Qualifications -

Experience: Classification:

Training:

Interest:

Remarks:

Surveillance -

Check Samples:

Last Visit by State:

Availability of Technical Assistance:

Remarks:

Comments -

CHAPTER 88-26. WATER SUPPLY QUALITY CONTROL.

Sec.
88-2601. Declaration of policy; policy of law; Board of Health designated as agency to administer program.
88-2602. Definitions.
88-2603. Powers and duties of the Board of Health; agents and employees.
88-2604. Board of Health authorized to adopt bylaws, rules and regulations.
88-2605. Prohibited acts relating to water for water supply systems.
88-2606. Certificates of approval of operation of water supply systems; provisional certificates.
88-2607. Information to be furnished by holders of certificates and provisional certificates.
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88-2611. Appeal to superior court; procedure; hearing de novo without jury.
88-2612. Attorney General to represent board or Director in legal actions.
88-2613. Hearing officers appointed by board; qualifications.
88-2614. Emergency orders by board; immediate effect; hearing.
88-2615. Application by Director for injunction to prevent public health hazard.
88-2616. Penalty for violation of provisions of Chapter 88-26 or any rule or regulation adopted pursuant thereto.
88-2617. Chapter as supplementary to prior laws.
88-2618. Board designated as State agency to receive financial aid from Federal Government and other sources.

Editorial Note.—Acts 1964, p. 416, codified as Chapter 17-5 and § 17-9901, appears to operate upon somewhat the same subject-matter as the instant Chapter. However, Acts 1964, p. 499 et seq., the Health Code, of which the instant Chapter is a part, did not specifically repeal Acts 1964, p. 416, and it will be noted that § 88-2617 states that this Chapter is supplementary to prior laws. Chapter 17-5 was approved March 11, 1964 and effective July 1, 1964, whereas the instant Chapter was approved March 18, 1964 and also effective July 1, 1964. It would appear that the instant Chapter, being later in date of approval, would govern in case of conflict.

88-2601. **Declaration of policy; policy of law; Board of Health designated as agency to administer program.**—As a guide to the interpretation and application of this Chapter, it is hereby declared to be the policy of the State of Georgia that the public and community water supplies of the State shall be utilized prudently to the maximum benefit of the people and their use and need for such water and that the quality of such water is a major factor involving the health and welfare of all people in the State of Georgia. To achieve this end, the Government of the State shall assume responsibility for the quality of said water, and the establishment and maintenance of a water quality control program adequate for present needs and designed to care for the future needs of the State, provided that nothing contained herein shall be construed to waive the immunity of the State for any purpose.

This requires that an agency of the State be charged with this duty and that it have the authority to require the use of reasonable methods, that is, those methods which are not only scientifically possible but also economically feasible and physically attainable from a practicable standpoint to insure adequate water of the highest quality for water supply systems. It is the intent of this Title to provide administrative facilities and procedure within the executive branch of the Government for determining policy requirements and standards governing the sources, distribution, purification, treatment and storage of water for public or community water supply systems. Because of substantial and scientifically significant variations in the characteristics, usage, and effect upon public interest of the differences in surface and underground waters of the State, a uniform requirement or requirements will not necessarily apply to all waters of a segment or segments thereof. It is the intent of this Title to confer discretionary administrative authority upon the Board of Health of the State of Georgia to take these and related circumstances into consideration in its decisions and actions in determining, under the conditions prevailing in specific cases, those procedures to best protect the public interests.

The Board of Health of the State of Georgia is hereby designated as the State agency to administer the provisions of this Chapter consistent with the above-stated policy. (Acts 1964, pp. 499, 637.)

88-2602. **Definitions.**—Unless a different meaning is required by the context, the following terms as used in this Chapter shall have the meanings hereinafter respectively ascribed to them:

(1) "Department" means the Department of Public Health of the State of Georgia.

(2) "Board" means the Board of Health of the State of Georgia.

(3) "Director" means the Director of the Department of Public Health of the State of Georgia.

(4) "Waters" or "waters of the State" means and includes any and all rivers, streams, creeks, branches, lakes, reservoirs, ponds, drainage systems, springs, wells, and all other bodies of surface or underground water, natural or artificial, of this State.

(5) "Person" or "persons" means any individual, firm, partnership, corporation, county, municipality, State or other entity. (Acts 1964, pp. 499, 638.)

88-2603. **Powers and duties of the Board of Health; agents and employees.**—In addition to the powers and duties now vested in and imposed upon the board by existing laws, the said board shall have the following powers and duties:

(1) To exercise general supervision over the administration and enforcement of this Chapter, and all rules, regulations and orders promulgated thereunder;

(2) To establish standards of quality for water that will be distributed in water supply systems;

(3) To establish such policies, requirements or standards governing the source, distribution, purification, treatment and storage of water for public or community water supply systems as it deems necessary for the reasonable and proper use thereof in conformity with the intent of this Chapter;

(4) To encourage, participate in or conduct studies, investigations, research and demonstrations relating to the quality and purity of waters for public or community water supply systems of the State as it deems advisable and necessary;

(5) To issue certificates covering the operation of public or community water supply systems stipulating in each certificate the conditions under which such certificate was issued and to deny, revoke, modify or amend certificates, such denial, revocation, modification or amendment to be made for good cause and after hearing upon at least 20 days notice to the person or persons operating such public or community water supply systems;

(6) To make investigations and inspections to insure compliance with this Chapter, rules and regulations issued pursuant thereto and any orders which the board may adopt or issue;

(7) To advise, consult, and cooperate with other agencies of the State, and political subdivisions thereof, and, with the approval of the Governor, to negotiate and enter into agreements with the Governments of other States and the United States and their several agencies on water quality matters insofar as said agreements relate to water for public and community water supply systems;

(8) To collect and disseminate information relating to quality of the water being furnished by the public and community water supply systems of the State;

(9) To adopt and promulgate rules and regulations applicable throughout the State governing the installation, use and operation of systems, methods and means for furnishing water to public or community water supply systems as may be determined necessary and such additional rules and regulations governing the procedures of the board with respect to: (a) the holding of hearings; (b) the filing of reports; (c) the issuance of certificates and orders; (d) and all other matters relating to procedure; and (e) to adopt, amend, modify or revoke any rule or regulation. All such rules and regulations herein authorized shall be consistent with the intent, purposes and provisions of this Chapter;

(10) To issue an order or orders directing any particular person or persons to secure, within the time specified herein, such operating results as are reasonable and practicable for furnishing water for public or community water supply systems. Such order or orders to be entered only after an opportunity to be heard has been afforded to the person or persons with at least 20 days notice to such person or persons of the

time, place and purpose thereof. No order shall become effective in less than 20 days after same has been served on the person or persons affected by mailing a copy thereof to such person or persons at the address given when such person or persons applied for the certificate as provided in this Chapter or at the principal office and place of business in this State of such person or persons;

(11) To exercise all incidental powers necessary to carry out the purposes of this Chapter.

The above and foregoing powers may be exercised and duties performed by the board through such duly authorized agents and employees as it deems necessary and proper. (Acts 1964, pp. 499, 639.)

88-2604. Board of Health authorized to adopt bylaws, rules and regulations.—The board is authorized to adopt such bylaws, rules and regulations as it deems necessary for the proper conduct of their proceedings in carrying out the duties imposed upon them by this Chapter. (Acts 1964, pp. 499, 641.)

88-2605. Prohibited acts relating to water for water supply systems.—It shall be unlawful for any person to erect, construct, enlarge, extend, open, reopen, or operate any public or community water supply system, including storage, distribution, purification treatment facilities or works, without having first secured from the board approval of: the source of water supply; the means and methods of treating, purifying and storing said water; plans and specifications for the construction of facilities or works; and the operation thereof. (Acts 1964, pp. 499, 641.)

88-2606. Certificates of approval of operation of water supply systems; provisional certificates.—(a) Any person or persons in this State using the waters in this State, in the operation of any public or community water supply system, may apply in writing to the board for a certificate of approval covering the operation of the public or community water supply system involved. Pending the final approval or disapproval of the board, the applicant shall be issued a provisional certificate. All applications shall be accompanied by such pertinent information as may be required by the board in rules and regulations adopted and promulgated hereunder such as certified copies of maps, plans and specifications in scope and detail satisfactory to the board and other relevant information. When such application and pertinent information have been reviewed, found satisfactory and given final approval by the board, a certificate shall be issued by the said board.

(b) A certificate properly issued by the board shall remain in effect until amended or revoked. Such amendment or revocation can be made only after determination by the board or its duly authorized agent that conditions have changed or will change significantly and only after reasonable notice has been given in writing to the certificate holder. (Acts 1964, pp. 499, 641.)

88-2607. Information to be furnished by holders of certificates and provisional certificates.—(a) Any holder of a provisional certificate whose application is pending final consideration shall upon request of the board provide such additional information as may be necessary to enable such board to properly pass upon its application.

(b) Any holder of a certificate shall on request of the board furnish such information reasonably necessary and pertinent as may be required by the board in the discharge of its duties under this Chapter. (Acts 1964, pp. 499, 642.)

88-2608. Inspections and investigations by agents of the board.—Any agent of the board shall be permitted access at all reasonable times in or upon any private or public property for the purpose of inspecting and investigating conditions, processes, methods of treatment, and records relating to the furnishing of water to the public, and affecting the quality of such waters of the State: Provided, that no person shall be required to disclose any secret formulae, processes, or methods used in any manufacturing operations carried on by him or under his direction or any confidential information concerning business activities carried on by him or under his supervision. (Acts 1964, pp. 499, 642.)

88-2609. Information obtained by board not admissible in evidence in private actions.—Information directly affecting any person obtained by the board, its agents, director, or employees of the Department of Public Health from studies, surveys, investigations, reports or from other sources as provided in this Chapter shall not be admissible in evidence in any actions at law or equity involving private rights of riparian owners other than the State. (Acts 1964, pp. 499, 642.)

88-2610. Certificate as no defense in civil action; no presumption created by findings of the board.—The fact that any person has held a certificate issued under this Chapter shall not constitute a defense in any action at law or equity involving private rights. A determination by the board that a violation or violations of any of the prohibitions contained in this Chapter, whether or not a proceeding or action may be brought by the State, shall not create by reason thereof any presumptions of law or findings of fact inuring to or for the benefit of persons or riparian owners other than the State. This Chapter is not intended to in any way create, enlarge or abridge existing rights of riparian owners or others. (Acts 1964, pp. 499, 642.)

88-2611. Appeal to superior court; procedure; hearing de novo without jury.—Any person who is a party to a proceeding and who is aggrieved or adversely affected by any final order or action of the board directed to such person shall have the right to appeal to the superior court of Fulton county or to the superior court of the county of his residence or principal place of business within the State. Such appeal shall be by petition which shall be filed in the clerk's office of such court within 20 days after the final order or action of the board: Provided, however, that the enforcement of the order or action appealed from shall not be stayed until and unless so ordered and directed by the reviewing court.

Upon the filing of such petition, the petitioner shall serve a copy thereof on the director in a manner prescribed by law for the service of process.

The judge shall hear the proceeding de novo, and shall thereupon determine all matters of law and fact without a jury and render his decision approving, setting aside or modifying the order or action appealed from. (Acts 1964, pp. 499, 643.)

Cross-reference.—Appeals under Health Code, generally, see § 88-305.

88-2612. Attorney General to represent board or Director in legal actions.—It shall be the duty of the Attorney General to represent the board or the Director or designate some member of his staff to represent them in all actions in connection with this Chapter. (Acts 1964, pp. 499, 643.)

88-2613. Hearing officers appointed by board; qualifications.—The board is authorized to appoint one or more hearing officers who shall hold hearings on charges of violations of this Chapter or rules and regulations issued pursuant hereto and make findings of fact, prepare such orders as may appear necessary and proper and return them to the board for consideration and action. To qualify as a hearing officer, a person must have been admitted to practice law before the highest court of this State. (Acts 1964, pp. 499, 643.)

88-2614. Emergency orders by board; immediate effect; hearing.—Whenever the board finds that an emergency exists requiring immediate action to protect the public health, it may without notice or hearing issue an order reciting the existence of such an emergency and requiring that such action be taken as it deems necessary to meet the emergency. Notwithstanding the provisions of section 88-2611 of this Chapter, such order shall be effective immediately. Any person to whom such order is directed shall comply therewith immediately but shall be afforded a hearing as soon as possible. On the basis of such hearing the board shall continue such order in effect, revoke it or modify it. (Acts 1964, pp. 499, 644.)

88-2615. Application by Director for injunction to prevent public health hazard.—Whenever in the judgment of the Director any person has engaged in or is about to engage in any act or practice which constitutes or will constitute an immediate public health hazard he may make application to the superior court of the county in which the act or practice has been or is about to be engaged in, for an order enjoining such act or practice, or for an order enforcing compliance with such provisions, and upon a showing by the Director that such person has engaged or is about to engage in any such act or practice, a permanent or temporary injunction, restraining order, or other order shall be granted without the necessity of showing lack of an adequate remedy at law. (Acts 1964, pp. 499, 644.)

88-2616. Penalty for violation of provisions of Chapter 88-26 or any rule or regulation adopted pursuant thereto.—Any person violating any provision of this Chapter or any rule or regulation adopted and promulgated hereunder or failing, neglecting or refusing to comply with any final order of the board, or a court, lawfully issued as herein provided, shall be guilty of a misdemeanor, and upon conviction be liable to punishment therefor as provided by law. Each day of continued violation after conviction shall constitute a separate offense. (Acts 1964, pp. 499, 644.)

88-2617. Chapter as supplementary to prior laws.—The provisions of this Chapter are intended to supplement existing laws and no part thereof shall be construed to repeal any existing laws affecting the powers and duties of the Board of Health or the Department of Public Health, nor repeal any existing laws for the protection of fish, shellfish and game or any provisions of the law governing the pollution of lakes and streams of the State. (Acts 1964, pp. 499, 645.)

Cross-reference.—See generally Title 17.

Editorial Note.—See Editorial Notes at beginning of this Chapter and of Chapter 17-5.

88-2618. Board designated as State agency to receive financial aid from Federal Government and other sources.—The board is hereby designated as the State agency to receive and administer financial aid from the Federal Government or other public or nonprofit sources for purposes of water quality control or any other purposes relating to the furnishing of water to public or community water supply systems. (Acts 1964, pp. 499, 645.)

CHAPTER 88-27. MISCELLANEOUS.

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88-2701. Board for distribution of unclaimed dead bodies.—Professors and demonstrators of anatomy and the deans of medical and dental colleges incorporated under the laws of this State are a board for the dis-

RULES
OF THE
DEPARTMENT OF PUBLIC HEALTH

DIVISION OF PHYSICAL HEALTH

CHAPTER 270-5-15

WATER SUPPLY QUALITY CONTROL

RULES AND REGULATIONS. - Pursuant to the authority vested in the State Board of Health and the Department of Public Health under Georgia Laws 1964, pages 499, 507, 637-645, Chapter numbered 270-5-15 entitled "Water Quality Regulations", Rules numbered 270-5-15-.01 through 270-5-15-.03 is hereby repealed in its entirety and in lieu thereof a new Chapter numbered 270-5-15 entitled "Water Supply Quality Control", Rules numbered 270-5-15-.01 through 270-5-15-.20, has been enacted to read as follows:

RULES
OF THE
DEPARTMENT OF PUBLIC HEALTH

DIVISION OF PHYSICAL HEALTH

CHAPTER 270-5-15

WATER SUPPLY QUALITY CONTROL

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270-5-15-.01 DEFINITIONS. - Unless a different meaning is required by the context, the following terms as used in this Rule shall have the meaning hereinafter respectively ascribed to them:

(a) "Board" means the Board of Health of the State of Georgia.

(b) "Department" means the Department of Public Health of the State of Georgia.

(c) "Finished Water" means water supplied for domestic use or human consumption from a public or community water supply system meeting the Drinking Water Standards as set forth in Section 270-5-15-.19.

(d) "Person" or "Persons" means any individual, firm, partnership, corporation, county, municipality, state or other entity.

(e) "Professional Engineer" means a person registered to practice professional engineering in accordance with the provisions of an Act Governing the Practice of Professional Engineering in Georgia (Georgia Laws, 1945, p. 294, as amended).

(f) "Public or Community Water Supply System" means any water supply system regardless of ownership or operation, serving or intended to serve water for domestic use of human consumption to the public or any segment thereof, except an individual water supply system serving a single family dwelling. They are classified as follows:

1. **Class I.** Water Supply Systems supplying finished water from any surface water sources.

2. **Class II.** Water Supply Systems supplying finished water from ground water sources to more than twenty-five (25) housing units or mobile units, to schools, to State owned facilities, and to industrial operations employing more than one hundred (100) persons.

3. Class III. All other water supply systems supplying finished water from ground water sources, including but not limited to, tourist accommodations, food service establishments, and commercial establishments.

(g) "Owner" means any person or persons owning a public or community water supply system.

(h) "Storage Tanks" means any covered structure, such as clearwell, standpipe, reservoir, elevated storage tank, hydropneumatic tank, or other storage facility, or combination thereof, used to store finished water.

(i) "Water" or "Waters of the State" means and includes any and all rivers, streams, creeks, branches, lakes, reservoirs, ponds, drainage systems, springs, wells, and all other bodies of surface or underground water, natural or artificial, of this State.

(j) "Water Supply System" means the source of supply and storage, distribution, purification, and treatment facilities, or works, of public or community water supply systems.

(k) "Ground Water" means waters obtained from drilled, bored or dug wells, or springs used as a source of water for a public or community water supply system.

Legal Authority: Ga. Laws 1964, pages 499, 507, 637-645.

270-5-15-.02 DESIGNATION OF DEPARTMENT AS PROPER AUTHORITY TO ADMINISTER AND ENFORCE RULES. - The Board of Health of the State of Georgia designates the Department of Public Health of Georgia as the proper authority to administer and enforce these rules and regulations. Provided that the County Board of Health is authorized to act as agent of the Department of Public Health in the administration of those Class III water systems defined above.

Legal Authority: Ga. Laws 1964, pages 499, 507, 637-645.

270-5-15-.03 APPROVAL REQUIRED. - No person shall erect, construct, enlarge, extend, open, reopen, or operate any public or community water supply system without having first applied for and secured from the Department approval of the source of water supply; means and methods of treating, purifying, storing and distributing of said water; plans and specifications for the construction of facilities or works; and the operation of said public or community water supply system.

Legal Authority: Ga. Laws 1964, pages 499, 507, 637-645.

270-5-15-.04 GENERAL PROVISIONS. -

(1) During the planning stage of a public or community water supply system there shall be submitted to the Department an Engineering Report prepared by a Professional Engineer accompanied by a letter of transmittal from the owner, or on his behalf, by a Professional Engineer. The Engineering Report shall be submitted for approval prior to the preparation of the plans and specifications. The Engineering Report may be waived for Class III water supply systems by the Department when by letter, report, or information submitted by the owner, or on his behalf, by a Professional Engineer, an engineering appraisal of the proposed water supply system can be made by the Department.

(2) Plans and specifications for the construction of a public or community water supply system, shall be prepared by a Professional Engineer, and submitted in duplicate to the Department, accompanied by a letter of transmittal from the owner, or on his behalf, by a Professional Engineer, at least 15 days in advance of starting any construction on such a system. Plans and specifications may be waived for Class III water supply systems by the Department when by letter, report, or information submitted by the owner, or on his behalf, by a Professional Engineer, an engineering appraisal of the proposed water supply system can be made by the Department.

(3) Continuity of maintenance and operation of a privately owned public or community water supply system shall be provided by a trust indenture, or other legal agreement between the owner and second party, or parties, acceptable to the Department.

Legal Authority: Ga. Laws 1964, pages 499, 507, 637-645.

270-5-15-.05 SOURCE OF WATER SUPPLY. -

(1) Prior to the approval of a source of water supply for a public or community water supply system by the Department, it shall be necessary for the owner, or his agent, to collect raw water samples and submit them to the Department for bacteriological examination.

(2) A surface water source shall be considered to include all tributary streams and drainage basins above the point of water supply intake, including natural lakes and artificial reservoirs, which may affect a specific water supply. Bathing, water skiing, boating, fishing, or other activities in or on any water used as a source of water supply shall be prohibited unless evidence is presented to the Department that the water quality will not be adversely affected as a source of water supply by these activities.

(a) The source of surface water supply shall be adequate to meet the total water demand as well as reasonable surplus for anticipated growth. For domestic use or human consumption one hundred (100) gallons per capita per day for the estimated projected population to be served at the end of the design period shall be adequate. For an impoundment source, allowance shall be made for required water releases, evaporation, seepage and siltation. Available stream flow and weather records shall be used in estimating the yield of the source.

(b) The raw surface water shall be of such quality that by providing reasonable water treatment facilities, the finished water shall meet Drinking Water Standards as set forth in Section 270-5-15-.19.

(3) For Class II water supply systems, ground water sources shall be from drilled wells

or springs. For Class III water supply systems, bored or dug wells, in lieu of drilled wells, may be used at the discretion of the Department upon receipt of evidence satisfactory to the Department that the quality of the ground water will meet Drinking Water Standards as set forth in Section 270-5-15-.19, and the water supply shall be adequate to meet the total demand of the area to be served.

(a) The source of ground water supply shall be adequate to meet the total water demand as well as reasonable surplus for anticipated growth. For domestic use or human consumption, one hundred (100) gallons per capita per day for the estimated projected population to be served at the end of the design period shall be adequate.

(b) The raw ground water shall be of such quality that by providing reasonable water treatment facilities, the finished water will meet Drinking Water Standards as set forth in Section 270-5-15-.19.

Legal Authority: Ga. Laws 1964, pages 499, 507, 637-645.

270-5-15-.06 ENGINEERING REPORT. - The Engineering Report shall contain a comprehensive description of the feasibility of the proposed project. The report shall include, but not be limited to, the following information:

(a) scope and description of the proposed water supply system;

(b) description of the proposed source of water supply to be developed;

(c) data concerning quality and quantity of the source of water supply;

(d) pertinent reference to, and information regarding present available sources of water supply, water treatment facilities, and water supply systems;

(e) general plan maps, charts, tables, and graphs;

(f) operational and maintenance costs;

(g) the known character and depths of the natural earth formations through, and from which, ground water sources are to be developed; and

(h) factors which may affect the quality of a surface water supply as determined by a sanitary survey of the watershed above the raw water intake.

Legal Authority: Ga. Laws 1964, pages 499, 507, 637-645.

270-5-15-.07 GENERAL PLAN MAP REQUIREMENTS. - The general plan map shall include, but not be limited to, the following information:

(a) pertinent information regarding the present water supply system;

(b) location of all existing and proposed streets;

(c) elevations of the principal parts of the water supply system, such as the intake, well or spring, treatment facilities, storage tanks, and the highest and lowest points to be served;

(d) the location of impounding lakes and structures, dams, intakes, conduits, wells or springs, treatment facilities, valves, hydrants, storage tanks and any other structures pertaining to or affecting the water supply system;

(e) the location and size and type of the material of the existing and proposed water mains;

(f) highest and lowest possible elevations of the surface of the water at the intake structures;

(g) direction of the true or magnetic north, title of the project, scale in feet, date boundaries of the municipality or area to be served;

(h) for a ground water source, location of existing wells, test holes, sewers, septic tanks, privies, sink holes, mines, quarries, natural and constructed impoundments, and surface water course in the project area; and

(i) index map showing the total area covered by the various map sheets bound together.

Legal Authority: Ga. Laws 1964, pages 499, 507, 637-645.

270-5-15-.08 PLANS AND SPECIFICATIONS. -

(1) Plans for a water supply system shall include, but not be limited to, the following information:

(a) general plan of the municipality or area to be served by the water supply system, including the location of all existing and proposed streets;

(b) plans showing the source and treatment facilities of the water supply system including the layout and relationship of the various units of the treatment processes, general piping system, pumps, reservoirs, and reserve area for future expansion. The detailed plan shall include, but not be limited to:

1. charts, calculations, tables, basis of design, and graphs;

2. contours at not more than five (5) foot intervals for existing and proposed grades;

3. longitudinal and transverse sections, sufficient to show the construction of each structure, unit and component of the treatment facility;

4. mixing and coagulating facilities, underdrainage and wash systems, size and depth of filtering material in the filter, flow measuring devices, points of application of chemicals, sampling points and plant control laboratory;

5. sufficient dimensions and elevations to make all parts of the plans readily understandable.

(c) the dimensions of the plan sheets shall be twenty (20) to thirty (30) inches in height, and twenty-four (24) to forty-two (42) inches in width;

(d) each plan sheet shall have printed thereon the name of the water supply system, name and registration stamp of the Professional Engineer, date, scale and such references in the title as are necessary for complete identification of the water supply system. The sheets of a set shall be bound together and numbered consecutively, and shall show the total number of sheets in the set: for example 1 of 10. 2 of 15.

(2) Specifications shall describe the plans for the whole and for each unit or component of the proposed water supply system and shall include, but not be limited to:

(a) a list of the plant laboratory equipment necessary to make all the analysis for the control of the treatment processes involved, with manufacturer's or supplier's catalog numbers;

(b) flow measuring devices provided at selected points in the system;

(c) provisions for flowing recording devices at all treatment plants;

(3) Approval of plans and specifications by the Department does not include approval of the structural, electrical, or mechanical integrity of the design of the treatment units or equipment.

Legal Authority: Ga. Laws 1964, pages 499, 507, 637-645.

270-5-15-.09 DEVIATION FROM APPROVED PLANS OR SPECIFICATIONS. - Any deviation from approved plans or specifications affecting capacity, hydraulic conditions, operating units, the functioning of water treatment processes, or the quality of the water to be delivered must receive prior approval by the Department. Revised plans or specifications shall be submitted for review and approval not less than fifteen (15) days before the proposed date of beginning construction.

Legal Authority: Ga. Laws 1964, pages 499, 507, 637-645.

270-5-15-.10 WATER TREATMENT FACILITIES. -

(1) The surface water treatment plant shall provide finished water and shall be of such design and capacity to provide the facilities for mixing, flocculation, followed by sedimentation and filtration, through acceptable media, of the raw water, and covered clearwell storage and continuous disinfection with chlorine gas or suitable chlorine compound.

(2) The ground water treatment plant shall provide finished water and shall be of such design and capacity to provide the facilities for chemical feed equipment, chlorination, and such other treatment as may be determined by the Department.

(3) Raw water intakes shall be screened.

(4) Multi-level intakes shall be provided where raw water quality requires selective draw-off.

(5) Raw water lines shall be equipped with flow metering devices with recorders.

(6) Chemical Feed Equipment.

(a) Chemical feeders shall be of such design and capacity to supply, at all times, the necessary amounts of chemicals at an accurate rate to the raw and finished water.

(b) Positive displacement type solution feed pumps may be used to feed liquid chemicals to the raw and finished water.

(7) Initial Mixing. The entire flow of raw water shall be uniformly treated with coagulating chemicals and subjected to turbulence to obtain complete mixing of the chemicals. Retention time shall be not less than thirty (30) seconds.

(8) Flocculation. The treated water shall be subjected to mild turbulence to permit flocculation. A retention period of forty-five (45) minutes for flocculation shall be sufficient.

(9) Sedimentation. The detention time for effective clarification is related to the basin design and shall be established on the basis of the raw water characteristics.

(a) Plants with conventional sedimentation shall provide a minimum of four (4) hours retention time.

(b) For a sedimentation basin not equipped with continuous sludge removal, additional capacity shall be provided in the design of the basin to allow for sludge storage.

(10) Filtration. Filters shall be of gravity or pressure type. The nominal rate of filtration shall be two (2) gallons per minute per square foot of filter area except for higher rates that are justified by the designing engineer and approved by the Department.

(11) Finished water only shall be used for back-washing the filters.

(12) Chlorination.

(a) Chlorination equipment and cylinders of liquid chlorine shall be stored in a building or room provided for that purpose, and separate from the other water treatment facilities and chemicals unless otherwise approved by the Department.

1. Forced ventilation shall be provided to exhaust any leaking chlorine gas.

2. A chlorine gas mask shall be provided outside the chlorine building or room and readily accessible for emergencies.

3. A small bottle of fresh ammonia solution shall be provided for testing for chlorine gas leaks.

(b) Hypochlorite feeders of the positive displacement type are acceptable and shall be of such design that it will operate accurately over the desired feed range.

(c) Provisions shall be made for the application of chlorine to the raw and finished waters. Chlorine dosage shall be sufficient to maintain a chlorine residual in the finished water as set forth in Section 270-5-15-.14 (1).

(13) Fluoridation. (where such practice is utilized).

(a) Fluoridation equipment shall be stored in a building or room provided for that purpose unless otherwise approved by the Department.

(b) Equipment shall be sized to provide for a chemical feed rate sufficient to maintain a fluoride residual in the finished water as set forth in Section 270-5-15-.19 (3).

Legal Authority: Ga. Laws 1964, pages 499, 507, 637-645.

270-5-15-.11 WELLS. -

(1) No person may locate a well less than fifty (50) feet from a septic tank, or less than

one hundred (100) feet from a septic tank absorption field, or less than ten (10) feet from a sewer. Greater distances from septic tank systems and sewers may be required at the discretion of the Department due to topography, local soil or geological conditions.

(2) The pumping equipment and water treatment facilities shall be in enclosed shelters which are of weather-and-vandal-proof construction. This requirement may be waived for Class III water supply systems by the Department when evidence is presented to the Department showing a satisfactory alternate method for protecting the pumping equipment and treatment facilities.

(3) All permanent casing, liners, screens and any other manufactured material used in the construction of a drilled well, shall be of new material. All outer and inner casing and liners shall be of steel or wrought iron having the following minimum wall thickness for the size indicated:

Size, Nominal Diameter In Inches	Steel Wall Thickness In Inches	Wrought Iron Wall Thickness In Inches
3	0.215	0.220
4	0.237	0.244
6	0.280	0.286
8	0.322	0.329
10	0.365	0.372
12	0.375	0.383
18	0.375	0.417
20	0.375	0.500
24	0.500	0.500

All casing and liner joints shall be made with threaded couplings, or shall be welded.

(4) The outer, permanent, protective casing shall extend at least five (5) feet into the first solid, unweathered or impervious subsurface rock strata encountered, and shall have a minimum length of twenty-five (25) feet from the ground surface into the wells drilled to water-bearing formations in crystalline rocks and fifty (50) feet in wells drilled to sedimentary water-bearing formations. The outer, permanent, protective casing shall be cement grouted to not less than a minimum depth of twenty-five (25) feet in crystalline rock and a minimum depth of fifty (50) feet in sedimentary rock with a cement slurry consisting of not more than six (6) gallons of water to one cubic foot of cement, plus standard additives to facilitate placing or setting. The cement grout shall be placed under pressure from the bottom of the annular space to be grouted upward until the grout is extruded at the earth's surface. The wall thickness of the cement grout surrounding the outer, permanent, protective casing shall be not less than one-and one-half (1½) inches at any point. Subsurface well construction shall cease for at least twenty-four (24) hours after grouting.

(5) A concrete slab with a minimum thickness of six (6) inches shall be constructed around the well casing and shall extend at least two (2) feet in all directions from the well casing, and have sufficient slope to allow complete drainage away from the well.

(6) For turbine pump installation, a concrete block to support the pump motor shall be constructed around the outer well casing and shall extend at least twelve (12) inches above the concrete slab, and

(a) the outer well casing shall extend at least one (1) inch above the pump motor block, and

(b) the well head and pump base shall be sealed to prevent seepage.

(7) For submersible pump installation, the outer well casing shall extend at least twelve (12) inches above the concrete slab and be fitted with a sealed cover plate.

(8) All well casing shall be vented by a riser pipe of such design that the screened opening terminates downward at least twelve (12) inches above the concrete slab.

(9) Raw water sampling tap shall be provided on the well water discharge pipe.

(10) The blow-off pipe from the well shall terminate at a point not subject to submergence by flood waters.

(11) Existing drilled wells that are deepened shall be regarded as development of a new ground water source.

(12) When an existing well is to be rehabilitated or re-worked, the Department shall be notified. Before the well has been placed back into service, disinfection of the well shall be required as set forth in Section 270-5-15-.14 (4).

(13) The owner shall plug and seal all drilled holes found to be unsatisfactory for development as a source of water supply to restore, as nearly as possible, the natural earth condition existing before the hole was drilled.

(14) Construction Operations.

(a) During the periods of stoppage of the drilling of a well the person drilling the well shall have the well opening securely covered to prevent tampering or vandalism.

(b) During drilling and cement grouting operations, the premises, construction materials, tools and equipment, shall be maintained in a sanitary manner to prevent contamination of the well by the person drilling the well.

(c) The gravel for gravel-packed wells shall be washed, free of organic matter, and composed of well-rounded particles.

(d) The water used in cement grouting operations shall meet Drinking Water Standards as set forth in Section 270-5-15-.19.

(15) Construction Data. The person drilling the well shall maintain accurate drillers logs, material setting data, and complete results of the pumping test for wells, including static and pumping water levels, and shall send copies of the data to the owner and the Department immediately following completion of the well.

(16) The owner, or his agent, shall furnish the Department with samples of the raw water for bacteriological examination. He shall also furnish the results of the physical and chemical analysis of the raw water performed by a private water testing laboratory in order that any treatment processes may be determined that are necessary to provide a finished water.

Legal Authority: Ga. Laws 1964, pages 499, 507, 637-645.

270-5-15-.12 SPRINGS. -

(1) A spring to be developed as a ground water source shall be protected by an enclosed structure. The walls of the enclosed structure shall extend down to bed-rock, or into the soil sufficiently to provide for a proper foundation to prevent surface water seepage.

(a) All surface water-run-off shall be diverted from the spring.

(b) The spring area shall be fenced to prevent unauthorized entry.

(c) Flooding of the spring by back-flow is prohibited.

(d) The over-flow from the spring enclosing structure shall be designed to prevent contamination of the spring.

(2) The pumping and water treatment facilities shall be enclosed in shelters which are of weather-and-vandal-proof construction.

(3) The owner, or his agent, shall furnish the Department with samples of the raw water for bacteriological examination. He shall also furnish results of the physical and chemical analysis of the untreated water performed by a private water testing laboratory in order that any treatment processes may be determined that are necessary to provide a finished water.

270-5-15-.13 STORAGE TANKS AND DISTRIBUTION SYSTEM. -

(1) Distribution mains, storage tanks, pipes, and other parts of a water supply system shall be of sufficient size and design to furnish at all times an adequate supply of water under a minimum pressure of 20 pounds per square inch at the service connection.

(2) No pipe in a distribution system may be smaller than 1½ inches internal diameter.

(3) All storage tanks shall be provided with a permanent cover and with screened vents and means of draining.

(4) No person may make a physical connection between the distribution system and any pipes, pumps, hydrants, or tanks whereby unsafe or other contaminating materials may be discharged or drawn into the system.

(5) No person may make any inter-connection between separate public or community water supply systems without obtaining written approval from the Department fifteen (15) days prior to making such inter-connections.

Legal Authority: Ga. Laws 1964, pages 499, 507, 637-645.

270-5-15-.14 DISINFECTION. -

(1) All newly constructed water supply systems or extensions, modifications, or repairs to existing water supply systems, including wells, water mains, storage tanks, and other pipes, or parts of the water supply system in which finished water is delivered, treated or stored, shall be disinfected before being placed or replaced into service by the owner, or his agent.

(2) Storage Tanks. After construction or repairs have been effected and painting has been completed, the storage tanks shall be disinfected before it is placed, or replaced into service. One of the three alternate methods of disinfection shall be used:

(a) First Method. After the storage tank has been thoroughly dried, it shall be filled slowly to the over-flow level with potable water, to which enough chlorine has been added to produce a minimum concentration of fifty (50) parts per million throughout the full tank. The chlorine, either as high-test calcium hypochlorite, or liquid chlorine, shall be introduced into the water supply as early during the filling operation as possible. After the tank has been filled, it shall stand full for a minimum of twenty-four (24) hours. After the holding period, the highly chlorinated water in the storage tank shall be completely drained to waste, and the tank shall be refilled from the regular supply. After refilling, samples of water shall be taken from the storage tank and tested to demonstrate that the water tank is bacteriologically satisfactory in accordance with Section 270-5-15-.19 (1) before the tank is placed in, or restored to, regular service.

(b) Second Method. Water containing a minimum of fifty (50) parts per million chlorine shall be placed in the storage tank to such depth that when the storage tank is filled the resultant chlorine concentration shall be not less than 2 parts per million. The water containing 50 parts per million chlorine shall be held in the storage tank for a minimum of 24 hours before the tank is filled. The full storage tank, in turn, shall be allowed to stand for 24 hours, after which samples shall be taken and tested to demonstrate that the quality of the water inside the storage tank is bacteriologically satisfactory in accordance with Section 270-5-15-.19 (1). The storage tank may be put into service without draining the water used to disinfect it.

(c) Third Method. The walls and bottoms of storage tanks shall be thoroughly cleaned to remove all dirt and loose material. A strong chlorine solution (at least 200 parts per million) shall be applied over the inner surface of the empty storage tank. The surface disinfected shall remain in contact with the strong chlorine solution at least thirty (30) minutes before the structure is filled with water. Samples shall be taken and tested to demonstrate that the quality of the water inside the storage tank is bacteriologically satisfactory in accordance with Section 270-5-15-.19 (1) before the storage tank is placed in, or restored to, regular service.

(3) Water Mains.

(a) Before being placed into service, all new water mains and repaired portions of, or extensions to, existing mains shall be chlorinated so that a chlorine residual of not less than 10 parts per million remains in the water after 24 hours standing in the pipe.

(b) The chlorinating agent shall be chlorine gas, chlorine gas-water mixture, or chlorine-bearing compound of known chlorine content mixed with water.

(c) The chlorinating agent shall be applied by means of a solution-feed device or, the chlorine gas shall be fed directly through proper devices for regulating the rate of flow and providing effective diffusion of the gas into the water within the pipe being treated. The application of a chlorine-compound placed within the pipe while the water main is being laid is not acceptable. For Class III water supply systems the direct application of dry hypochlorite, or a heavy slurry of it, on either side of the opening, before the new pipe and fittings are installed may be approved by the Department.

(d) The preferred point of application of the chlorinating agent is at the beginning of the water main extension, or at any valved section of the water main extension. Application of the chlorinating agent shall be through a corporation stop inserted in the top of the newly laid water main.

(e) Water from the existing distribution system or other approved source of supply shall be controlled so as to flow slowly into the newly laid water main during the application of chlorine. The rate of chlorine mixture flow shall be in such proportion to the rate of water entering the pipe that the chlorine dose applied to the water entering the newly laid water main shall produce at least 10 parts per million chlorine residual in the main at least 24 hours after application. This shall be expected with an application of 25 parts per million, although some conditions may require more.

(f) In the process of chlorinating newly laid water mains, all valves or other appurtenances shall be operated while the water is filled with the chlorinating agent in order to provide complete chlorination of the entire water supply system.

(g) Following chlorination all treated water shall be thoroughly flushed from the newly laid water mains at its extremities until the replacement water throughout its length shall, upon test, be proved comparable in quality to the water served the public from the existing water supply system.

(4) Wells.

(a) Wells shall be disinfected prior to the pumping test by the introduction of a chlorine solution into contact with the entire well-water casing under sufficient pressure to overcome the natural flow pressures of all developed water-bearing zones, and in sufficient quantity to produce a minimum chlorine residual of fifty (50) parts per million in six (6) hours after such application.

(b) After disinfection, the well shall be pumped until no trace of chlorine remains in the water, and a sample shall be taken for bacteriological analysis. No water may be furnished for domestic use or human consumption until samples of water are collected by the owner, or his agent, and submitted to the Department for bacteriological examination, and the quality of the water approved by the Department. If the water samples submitted are found to be unsatisfactory in accordance with Section 270-5-15-.19 (1), the disinfection procedure shall be repeated until satisfactory samples are received by the Department.

(c) The permanent pump and pumping equipment shall be disinfected with a chlorine solution prior to being placed into service.

Legal Authority: Ga. Laws 1964, pages 499, 507, 637-645.

270-5-15-.15 OPERATION. -

(1) The owner, or his agent, shall continuously chlorinate the water supply system to maintain a residual of chlorine in all parts of the distribution

system in the amount of at least 0.5 parts per million, and such additional amounts as may be determined necessary by the Department. This chlorination requirement may be waived by the Department for Class III public or community water supply systems after consideration of the bacteriological quality of the untreated water, local geology, extent of the distribution system and such other factors which may affect the operation of the public or community water supply system.

(2) The owner of Class I water supply systems shall have an experienced operator on duty at all times in which the water plant is in operation.

(3) All Class I water systems and those Class II water systems serving a population of more than 10,000 shall be provided with a chemical and bacteriological laboratory, maintained in good working order, equipped to perform all laboratory tests pertinent to the control of the plant operation.

(4) The owner of Class II water supply systems shall have an experienced operator available at all times.

(5) Class II and Class III water supply systems shall be provided with the equipment necessary to perform all laboratory tests pertinent to the control of the plant operation. It shall be maintained in good working order at all times.

(6) All chemical tests pertinent to the control of the plant operation shall be performed daily by the water plant operator in the water plant laboratory.

(7) Bacteriological and chemical tests shall be performed in the water supply system laboratory as outlined in the latest edition of Standard Methods for Examination of Water and Wastewater as published by the American Public Health Association, or as such tests may be modified by the Department. The number of water samples to be collected by the owner, or his agent, of the water supply system for the bacteriological tests shall be made as follows:

(a) Class I

1. Population served less than 5,000 - three samples per week. No two samples may be taken at the same location in any one week.

2. Population served 5,000 to 50,000 - samples taken daily, not less than 50 samples per month. No two samples may be taken at the same location in any one week.

3. Population served more than 50,000 - samples taken daily, not less than the minimum number of samples required per month according to the Public Health Service Drinking Water Standards, U.S. Department of Health, Education and Welfare, latest edition.

(b) Class II

1. Population served 10,000 to 50,000 - samples taken daily, not less than 50 samples per month. No two samples may be taken at the same location in any one week.

2. Population served more than 50,000 - samples taken daily, not less than the minimum number of samples required per month according to the Public Health Service Drinking Water Standards, U.S. Department of Health, Education and Welfare, latest edition.

(8) Samples of finished water for bacteriological analysis shall be taken at the treatment plant, or well, and at random points on the distribution system.

(9) Additional bacteriological samples may be required when it appears to the Department that circumstances necessitate such variation.

Legal Authority: Ga. Laws 1964, pages 499, 507, 637-645.

270-5-15-.16 CERTIFICATE OF APPROVAL. -

(1) Any person operating a public or community water supply system shall apply in writing to the Department for a Certificate of Approval governing the operation of the system. Application for approval shall be on forms prepared and furnished by the Department.

(2) The application shall include, but shall not necessarily be limited to, the following information relating to the water supply system:

(a) Name of the owner of the water supply system.

(b) Address and location of the water supply system.

(c) Description of the water supply system.

(d) When the system was built and placed in operation.

(e) Whether the plans and specifications of the system have been approved by the Department.

(f) Name of the designing engineer or engineering firm.

(g) Name and qualifications of the supervisor of the system.

(3) After a review of the application and information submitted, such additional information shall be submitted as may be required by the Department for a complete review and evaluation of the system. The additional information may consist of any one or more of the following:

(a) Engineering report.

(b) Plans and specifications.

(c) General map plan.

(d) Water main pressure measurements.

(e) Storage tank facilities.

(f) Qualitative and quantitative measurements.

(g) Operating records.

(4) Pending final approval or disapproval of the application, the applicant shall be issued a Provisional Certificate of Approval by the Department. This Provisional Certificate of Approval shall be non-transferable and shall remain in effect until the application is approved or disapproved; not to exceed one year from the date of filing the application for Certificate of Approval.

(5) The owner, or his agent, operating a public or community water supply system shall comply with all provisions of the Rules of this Chapter prior to the issuance of a Certificate of Approval by the Department.

(6) Any holder of a Certificate of Approval or a Provisional Certificate of Approval shall at any time, upon request of the Department, furnish such additional information as may be required for evaluation of the operation of the system.

(7) A Certificate of Approval issued by the Department shall stipulate the conditions of operation of the water supply system.

(8) A Certificate of Approval of the operation of a public or community water supply system, issued by the Department shall be for a specific water system as an entity and operated by the ownership to which such document has been issued. A Certificate of Approval is non-transferable and shall be valid until revoked, modified or amended.

Legal Authority: Ga. Laws 1964, pages 499, 507, 637-645.

270-5-15-.17 WATER SAMPLES. -

(1) For the purpose of evaluation the effectiveness of the operation of a water supply system, at least three samples of the finished water from public or community water supply systems shall be submitted to the Department by the owner, or his agent, monthly. Additional samples may be required by the Department to complete the evaluation of the operation and when the water samples, upon laboratory analysis, fail to meet Drinking Water Standards as set forth in Section 270-5-15-.19.

(2) For Class III water supply systems, one or more water samples, as may be determined by the Department shall be submitted by the owner, or his agent, at intervals of not more than six months.

(3) Upon request of the Department, raw water samples shall be submitted for analysis to the Department.

(4) The samples of finished water for bacteriological analysis shall be taken at the water treatment plant, well or spring, and at random points throughout the distribution system, with one sample from the approximate center and one sample from the extremity of the distribution system.

(5) Additional bacteriological samples analyzed in a laboratory approved by the Department will be accepted.

(6) The owner, or his agent, of a public or community water supply system shall obtain a special shipping case and bottles, approved by the Department, in which to submit water samples. The cost of the case and the postage for shipping the samples shall be defrayed by the owner of the water supply system.

Legal Authority: Ga. Laws 1964, pages 499, 507, 637-645.

270-5-15-.18 OPERATING RECORDS. -

(1) The owner, or his agent, for Class I and Class II public or community water supply systems shall compile and preserve accurate daily operating records of the water supply system on forms prepared and furnished by the Department, and the owner, or his agent, shall furnish true and correct copies to the Department monthly.

(2) For Class III water supply systems, operating records may be waived by the Department

upon receipt of evidence from the owner, or his agent, showing that a system is operated in accordance with Sections 270-5-15-.13, 270-5-15-.15, 270-5-15-.17, and 270-5-15-.19.

Legal Authority: Ga. Laws 1964, pages 499, 507, 637-645.

270-5-15-.19 DRINKING WATER STANDARDS. -

(1) Bacteriological Quality - Compliance with the bacteriological requirements of this Section shall be based on examination of the water samples submitted to the Department.

(a) The presence of organisms of the coliform group as indicated by samples examined shall not exceed the following limits:

1. When the multiple tube fermentation technique is used, not more than 10 per cent of all 10 milliliter (ml.) portions examined in any month shall show the presence of organisms of the coliform group. When organisms of the coliform group occur in three (3) or more 10 ml. portions of a single standard water sample, additional water samples from the sampling point shall be collected promptly and examined, and collection and submission of these additional water samples shall be required until the results obtained show the water to be of bacteriological quality as set forth in this Section.

2. When the membrane filter technique is used the arithmetic mean coliform density of all standard samples examined per month shall not exceed 1/100 ml. When coliform colonies in a single standard sample exceed 4/100 ml., samples from the sampling point shall be collected promptly and examined; collection and submission of these additional water samples shall be required until the results obtained show the water to be of bacteriological quality as set forth in this Section.

(2) Physical Characteristics. - The drinking water shall contain no impurity which will cause offense to the sense of sight, taste, or smell. The following limits shall not be exceeded:

Turbidity	5 units
Color	15 units
Threshold Odor No.	3

(3) Chemical Characteristics. Drinking water shall not contain chemical impurities in concentrations which may be hazardous to the health of the consumers, and shall not be excessively corrosive to the water supply system. Substances used in the treatment of drinking water shall not remain in the water in concentrations greater than required by good practice. Substances which may have deleterious physiological effect, or for which physiological effects are not known, shall not be introduced into the water supply system in a manner which would permit these substances to reach the consumer.

(a) The following chemical substance shall not be present in a water supply in excess of the listed concentrations where, in the judgment of the Department, other more suitable supplies are, or can be made available:

Substances	Concentrations in mg/l
Arsenic (As)-----------------	0.01
Chloride (Cl)----------------	250
Copper (Cu)------------------	1
Cyanide (CN)-----------------	0.01
Iron (Fe)--------------------	0.3
Manganese (Mn)---------------	0.05
Nitrate (NO_3)-------------	45
Phenols----------------------	0.001

Substances	Concentrations in mg/l
Sulfate (SO_4)	250
Total Dissolved Solids	500
Zinc (Zn)	5

(b) The presence of the following substances in excess of the concentration listed shall constitute grounds for rejection of the water supply:

Substances	Concentrations in mg/l
Arsenic (As)	0.05
Barium (Ba)	1.0
Cadmium (Cd)	0.01
Chromium (Hexavalent) Cr ^{6})	0.05
Cyanide (CN)	0.2
Lead (Pb)	0.05
Selenium (Se)	0.01
Silver (Ag)	0.05

(c) Fluoride. Fluoride concentrations in finished water shall not average more than the upper limits in the table below. Presence of fluoride in average concentrations greater than two times the optimum values in the table shall constitute grounds for rejection of the water supply.

1. Wherever fluorides are added, the fluoride shall be kept within the upper and lower control limits according to the following table:

Annual Average of Maximum Daily Air Temperature +F	Fluoride Concentration in mg/l		
	Lower	Optimum	Upper
Below 70.7	0.7	0.9	1.2
70.7 and above	0.7	0.8	1.0

2. The owner, or his agent, of fluoridated water supplies shall sample and analyze daily the fluoride concentration of the finished water. Daily records shall be kept and copies submitted monthly to the Department in accordance with Section 270-5-15-.18. Water samples shall be submitted monthly to the Department for confirmatory analysis of the fluoride concentration.

3. The owner, or his agent, shall submit plans and specifications in accordance with Sections 270-5-15-.08 and 270-5-15-.10 and receive prior approval from the Department before adding fluorides to the finished water.

(4) Water supply systems found to contain radioactivity shall conform to standards established by the Department in rules designated in Chapter 270-5-20, entitled "Radioactive Materials".

Legal Authority: Ga. Laws 1964, pages 499, 507, 637-645.

270-5-15-.20 ENFORCEMENT. - The administration and enforcement of these rules and regulations shall be as prescribed in Chapter 88-3, Enforcement and Administrative Procedures and Chapter 88-26, Water Supply Quality Control, of the Georgia Health Code (Georgia Laws 1964, pp. 518 637) and in compliance with the applicable requirements as prescribed by the Georgia Administrative Procedure Act (Georgia Laws 1964, pp. 338, as amended).

Legal Authority: Ga. Laws 1964, pages 499, 507, 637-645.

APPENDIX E

Report of a Survey of the
Georgia Department of Natural Resources

Water Supply Section Laboratory
47 Trinity Avenue SW
Atlanta, Georgia 30334
on September 12-13, 1972

by

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Environmental Protection Agency
Cincinnati, Ohio 45268

The equipment and procedures employed in the bacteriological analyses of water by this laboratory conformed with the provisions of Standard Methods for the Examination of Water and Wastewater (13th edition - 1971) and with the provisions of the Interstate Quarantine Drinking Water Standards, except for items marked with a cross "X" on the accompanying form EPA-103 (Rev. 3-71). Items marked with a "U" could not be determined at the time of the survey. Items marked "O" do not apply to the procedures programmed in the laboratory. Specific deviations are described with appropriate remedial action for compliance in the following recommendations:

Recommendations

Item 5 Record of Laboratory Examinations

If results indicate a sample to be unsatisfactory, municipal water plants are notified immediately by telephone. Resampling is initiated; however, only one resample is collected rather than the recommended two - - one resample on two consecutive days. Apparently only one resample is collected because sufficient additional sample bottles and mailing containers are not available to all municipal water treatment plants. The larger municipal plants have sufficient sample bottles and smaller plants located in an area near a County Health Department could request additional sample bottles from the County Health Department. However, smaller plants located in more remote areas should be supplied with extra sterile bottles which are rotated with their regular supply. This would insure that a sufficient number of bottles would be available when needed and the sterility of all the sample bottles. Compliance with resampling recommendations may require purchasing additional sample bottles and mailing containers.

Item 6 Laboratory Evaluation Service

Mrs. Eloise Stewart, Laboratory Scientist IV, was appointed the Georgia State Water Bacteriological Laboratory Survey Officer following the retirement of Elizabeth McEntire. Mrs. Stewart was certified as the Survey Officer after she demonstrated her proficiency during an evaluation of the City of Atlanta Hemphill Water Treatment Plant Bacteriological Laboratory. Mrs. Stewart has an excellent background in water bacteriology and demonstrated the personality and temperament desirable to obtain the cooperation of laboratory personnel in improving procedures without incurring a feeling of resentment.

The Laboratory survey program follows a triennial survey schedule. There are twelve laboratories, eleven are approved and one, City of Brunswick Sewage Treatment Plant Laboratory, is not, nor is there a written official survey report documenting this laboratory's status. Mrs. Stewart is cognizant of this deviation and requested certification as the State Survey Officer before this laboratory was re-evaluated.

Table 1 lists all laboratories surveyed in the State, the date of the last survey and the Survey Officer. The Cobb County Wyckoff Water Treatment Plant Laboratory, a recently established laboratory which does not examine interstate carrier water supplies, requested certification and will be evaluated by Mrs. Stewart.

Item 48 Completed Test

The confirmed test can yield positive reactions in the absence of the coliform group (false-positive test). Therefore, it is recommended that the validity of the confirmed test be established by comparison with the completed test. The number of comparative procedures depends upon the location and individual waters being examined. Approximately 20 comparative procedures each three months should be sufficient when there is good agreement. The number should be increased if results from the confirmed and completed tests differ. The completed test is the reference standard.

Item 50 MF Procedure

Rinsing of the filter funnel after filtration of the sample was discontinued when equipment was installed to sterilize funnels by ultra-violet between filtration of each sample. The use of UV light does eliminate bacterial "carry-over" from one sample to another; however, after each sample is filtered, it is necessary to rinse the funnel sufficiently so that all sample water droplets which can adhere to the walls of the funnel are flushed onto the membrane insuring detection of coliform organisms which may be present in the sample volume examined.

Item 51 Incubation

A high relative humidity (approximately 90%) should be maintained for incubation of membrane cultures for detection of coliform organisms; otherwise, moisture evaporates more rapidly from the membrane surface than is replenished by diffusion from the agar or absorbent pads. If the membrane becomes dry, as observed during the survey, colonies may fail to develop or may remain small with little or no sheen development. A simple procedure which prevents excessive evaporation is to place membrane cultures on a moist towel in a plastic vegetable crisper which has a tight fitting cover before incubation.

Table 1.

Status of Laboratories Examining Potable Water Supplies

Name of Lab	Date of Last Survey	Status	Survey Officer
City of Albany Water Plant Lab	May, 1969	Approved	E. McEntire
City of Atlanta Chattahoochie Water Plant Lab	Nov. 1971	Approved	E. McEntire
City of Atlanta Hemphill Water Plant Lab.	Sept. 1972	Approved	E. McEntire
City of Augusta Water Plant Lab	March 1971	Approved	E. McEntire
Savannah Chatam Co. Lab	Oct. 1971	Approved	E. McEntire
City of Columbus Water Plant Lab	Oct. 1969	Approved	E. McEntire
City of Macon Water Plant Lab	Aug. 1970	Approved	E. McEntire
City of Thomasville Water Plant Lab	May 1969	Approved	E. McEntire
City of Valdosta Water Plant Lab	Oct. 1971	Approved	E. McEntire
City of Waycross Water Plant Lab	April 1971	Approved	E. McEntire
City of Brunswick Sewage Treatment Plant Lab	Surveyed but no report	Not Approved	E. McEntire
Cobb Co. Wyckoff Water Plant Lab	New lab requesting certification Not associated with interstate carrier supply		

Personnel Approved

The following laboratory personnel are approved for the application of the total and fecal coliform multiple-tube fermentation procedure and total coliform membrane filter procedure to the bacteriological examination of drinking water and stream quality measurement:

Mrs. Eloise W. Stewart, Laboratory Scientist IV
Mrs. Helen B. Milledge, Chemist II
Mrs. Iris F. Palmer, Chemist II
Mrs. Jean B. Brown, Chemist I
Mrs. Sharon H. Snead, Chemist I
Mrs. Paula Culberth, Chemist I, is presently in training and could not be certified at this time.

Conclusions

The procedures and equipment in use at the time of the survey complied in general with the provisions of Standard Methods for the Examination of Water and Wastewater (13th edition - 1971) and with corrections of deviations listed, it is recommended that the results be accepted for the bacteriological examination of waters under interstate regulations.

Harry D Nash

Consulting Bacteriologist

ENVIRONMENTAL PROTECTION AGENCY
Water Quality Office
Water Hygiene Division
Bacteriological Survey for
Water Laboratories

Indicating conformity with the 13th edition of Standard Methods for the Examination of Water and Wastewater (1971).

Survey By Harry D. Nash	X = Deviation U = Undetermined O = Not Used	
Laboratory Georgia Dept. of Natural Resources, Water Supply Section Lab.	Location 47 Trinity Ave SW Atlanta, Ga. 30334	Date 9/12-13/72

Sampling and Monitoring Response

1. Location and Frequency

Representative points on system. U
Frequency of sampling adequate . . . . U

2. Collection Procedure

Faucets with aerators should not be used. . . . . U
Flush tap 1 min. prior to sampling . . . . U
Pump well 1 min. to waste prior to sampling . . . . U
River, stream, lake, or reservoir sampled at least 6 inches below surface and toward current. . . . . U
Minimum sample not less than 100 ml . . . . ____
Ample air space in bottle for mixing. . . . . ____
Promptly identify sample legibly and indelibly . . . . ____

3. Sample Bottles

Wide mouth, glass or plastic bottles of 250 ml capacity. . . . . ____
Sample bottles capable of sterilization and rinse . . . . ____
Closure:
- a. Glass stoppered bottles protected with metal foil, rubberized cloth or kraft type paper . . . . ____
- b. Metal or plastic screw cap with leakproof liner . . . . ____

Sodium thiosulfate added for dechlorination. . . . . ____
Concentration 100 mg/l added before sterilization . . . . . . ____
Chelation agent for stream samples (optional). . . . . ____
Concentration 372 mg/l added before sterilization . . . . . . ____

4. Transportation and Storage

Complete and accurate data accompanies sample . . . . ____
Transit time for potable water samples should not exceed . . . . . . ____
48 hrs, preferably within 30 hrs . . . . ____
Transit time for source waters, reservoirs, and natural bathing waters should not exceed 6 hrs . . . . ____
All samples examined within 2 hours of arrival . . . . ____

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Laboratory **Ga. Dept. of Natural Resources**
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4. Transportation and Storage (Continued)

Sample refrigeration mandatory on stream samples, optional on potable water samples. . . . . ____

5. Record of Laboratory Examination

Results assembled and available for inspection . . . . ____

Number of Tests per year

MPN Test - Type of sample **7,442 Private** **1,911 streams**

Confirmed (+)____ (-)____ (Total)____

Completed (+)____ (-)____ (Total)____

MF Test - Type of sample **30,235**

Direct Count (+)____ (-)____ (Total)____

Verified Count (+)____ (-)____ (Total)____

Data processed rapidly through laboratory and engineering sections . . ____

Unsatisfactory sample defined as **1** or more positive tubes per MPN test or **1** or more colonies per 100 ml in MF test . . . . ____

High priority placed on alerting operator to unsatisfactory potable water results . . . . ____

Prompt resampling for unsatisfactory samples . . . . **X**

6. Laboratory Evaluation Service

State program to evaluate all laboratories which examine potable water supplies . . . . ____

Frequency of surveys on a **3** year basis . . . . ____

State survey officer (Name) **Mrs. Eloise Stewart** . . . . ____

Status of laboratory evaluation service . . . . ____

Total **12** labs known to examine water

11 approved laboratories

____ provisional laboratories

1 not certified **City of Brunswick.** . . . . **X**

Laboratory Apparatus

7. Incubator

Manufacturer ________ Model ________

Sufficient size for daily work load . . . . ____

Maintain uniform temperature in all parts (± 0.5°C). . . . . ____

Accurate thermometer with bulb immersed in liquid on top and bottom shelves. . . . . ____

Daily record of temperature or use of recording thermometer sensitive to 0.5°C change . . . . ____

Incubator not subject to excessive room temperature variations beyond a range of 50 - 80°F . . . . ____

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8. Incubator Room (Optional) Manufacturer **Built-in**

Well insulated, equipped with properly distributed heating and humidifying units for optimum environmental control. . . . . . ____

Shelf areas used for incubation must conform to 35°C ± 0.5° temperature requirement. . . . . ____

Accurate thermometers with bulb immersed in liquid. . . . . ____

Daily record of temperature at selected areas or use recording thermometer sensitive to 0.5°C changes . . . . ____

9. Water Bath

Manufacturer ____ Model **Blue M**

Sufficient size for fecal coliform tests . . . . ____

Maintain uniform temperature 44.5°C ± 0.2°C. . . . . ____

Accurate thermometer immersed in water bath . . . . ____

Daily record of temperature or use of recording thermometer sensitive to 0.2°C changes . . . . ____

10. Hot Air Sterilizing Oven

Manufacturer **American Sterilizer** Model **Cyclomatic**

Size sufficient to prevent crowding of interior . . . . ____

Constructed to insure a stable sterilizing temperature . . . . ____

Equipped with accurate thermometer in range of 160-180°C or with recording thermometer . . . . ____

11. Autoclave

Manufacturer **American Sterilizer** Model **845-B**

Size sufficient to prevent crowding of interior . . . . ____

Constructed to provide uniform temperature up to and including 121°C . . . . ____

Equipped with accurate thermometer with bulb properly located to register minimal temperature within chamber . . . . ____

Pressure gage and operational safety valve . . . . ____

Steam source from saturated steam line, or from gas or electrically heated steam generator . . . . ____

Reach sterilization temperature in 30 min. . . . . ____

Pressure cooker may be used only if provided with a pressure gage and thermometer with bulb 1 in. above water level . . . . ____

12. Thermometers

Accuracy checked with thermometer certified by National Bureau of Standards or one of equivalent accuracy. . . . . ____

Liquid column free of discontinuous sections and graduation marks legible . . . . ____

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13. pH Meter

Manufacturer Orion Research Model 701

Electronic pH meter accurate to 0.1 pH units. . . . . ____

14. Balance

Balance with 2 g sensitivity at 150 g load used for general media preparations, Type Mettler . . . . ____

Analytical balance with 1 mg sensitivity at 10 g load used for weighing quantities less than 2 g, Type ________ . . ____

Appropriate weights of good quality for each balance . . . . ____

15. Microscope and Lamp

Preferably binocular wide field, 10 to 15 diameters magnification for MF colony counts, Type B & L . . . . . . ____

Fluorescent light source for sheen discernment. . . . . ____

16. Colony Count

Quebec colony counter, dark-field model preferred for standard plate counts . . . . ____

17. Inoculating Equipment

Wire loop of 22 or 24 gauge chromel, nichrome, or platinum iridium, sterilized by flame . . . . ____

Single-service transfer loops of aluminum or stainless steel, presterilized by dry heat or steam. . . . . ____

Disposable single service hardwood applicators, presterilized by dry heat only. . . . . ____

18. Membrane Filtration Units

Manufacturer Millipore Type Stainless Steel

Leak proof during filtration. . . . . ____

Metal plating not worn to expose base metal . . . . ____

19. Membrane filters

Manufacturer Millipore Type ________

Full bacterial retention, satisfactory filtration speed . . . . ____

Stable in use, glycerin free. . . . . ____

Grid marked with non-toxic ink . . . . ____

Presterilized or autoclaved 121°C for 10 min. . . . . ____

20. Absorbent Pads

Manufacturer Millipore Type ________

Filter paper free from growth inhibitory substances. . . . . ____

Thickness uniform to permit 1.8 - 2.2 ml medium absorption . . . . ____

Presterilized or autoclaved with membrane filters . . . . ____

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21. Forceps
Preferably round tip without corrugations. . . . . ____
Forceps are alcohol flamed for use in MF procedure. . . . . ____

Glassware, Metal Utensils and Plastic Items

22. Media Preparation Utensils
Borosilicate glass . . . . ____
Stainless steel. . . . . ____
Utensils clean and free from foreign residues or dried medium. . . . . ____

23. Pipets
Brand Kimax Type Glass
Calibration error not exceeding 2.5%. . . . . ____
Tips unbroken, graduation distinctly marked . . . . ____
Deliver accurately and quickly. ____
Mouth end plugged with cotton (optional) . . . . ____

24. Pipet Containers
Box, aluminum or stainless steel . . . . ____
Paper wrapping of good quality sulfite paper (optional) . . . . ____

25. Petri Dishes
Brand Kimax Type Glass
Use 100 mm x 15 mm dishes for pour plates . . . . ____
Use 60 mm x 15 mm dishes for MF cultures . . . . ____
Clear, flat bottom, free from bubbles and scratches. . . . . ____
Plastic dishes may be reused if sterilized in 70% ethanol for 30 min. or by ultraviolet radiation . . . . ____

26. Petri Dish Containers
Aluminum or stainless steel cans with covers, coarsely woven wire baskets, char-resistant paper sacks or wrappings . . . . ____

27. Culture Tubes
Size sufficient for total volume of medium and sample portions . . . . ____
Borosilicate glass or other corrosive resistant glass . . . . ____

28. Dilution Bottles or Tubes
Borosilicate or other corrosive resistant glass . . . . ____
Screw cap with leak-proof liner free from toxic substances on sterilization . . . . ____
Graduation level indelibly marked on side of bottle or tube . . . . . . ____

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Materials and Media Preparation

29. Cleaning Glassware

Dishwasher Manufacturer Heinicke Model ____
Thoroughly washed in detergent at 160° F, cycle time 2 min. . . ____
Rinse in clean water at 180° F, cycle time 2 min. . . . . . . ____
Final rinse in distilled water, cycle time 1.5 min. . . . . . . ____
Detergent brand Labcol
Washing procedure leaves no toxic residue . . . . ____
Glassware free from acidity or alkalinity . . . . ____

30. Sterilization of Materials

Dry heat sterilization (1 hr at 170°C)
Glassware not in metal containers . . . . ____
Dry heat sterilization (2 hrs at 170°C)
Glassware in metal containers. ____
Glass sample bottles . . . . ____
Autoclaving at 121°C for 15 min . . . . ____
Plastic sample bottles . . . . ____
Dilution water blanks . . . . ____

31. Laboratory Water Quality

Still manufacturer ____ Construction Material ____
Demineralizer with Barnstead recharge frequency
Protected storage tank . . . . ____
Supply adequate for all laboratory needs. . . . . ____
Free from traces of dissolved metals or chlorine . . . . ____
Free from bactericidal compounds as measured by bacteriological suitability test . . . . ____
Bacteriological quality of water measured once each year by suitability test or sooner if necessary . . . . ____

32. Buffered Dilution Water

Stock phosphate buffer solution pH 7.2 . . . . ____
Prepare fresh stock buffer when turbidity appears . . . . ____
Stock buffer autoclaved and stored at 5 - 10°C . . . . ____
1.25 ml stock buffer per 1 liter distilled water. . . . . ____
Dispense to give 99 ± 2 ml or 9 ± 0.2 ml after autoclaving. . . . . . ____

33. pH Measurements

Calibrate pH meter against appropriate standard buffer prior to use . . ____
Standard buffer brand ____ pH 4.0 and 7.0
Check the pH of each sterile medium batch or at least one batch from each new medium lot number. . . . . ____

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33. pH Measurements (Continued)

Maintain a pH record of each sterile medium batch, the date and lot number. . . . . ____

34. Sterilization of Media

Carbohydrate medium sterilized 121°C for 12 min . . . . ____

All other media autoclaved 121°C for 15 min . . . . ____

Tubes packed loosely in baskets for uniform heating and cooling. . . . ____

Timing starts when autoclave reaches 121°C . . . . ____

Total exposure of carbohydrate media to heat not over 45 min. . . . . ____

Media removed and cooled as soon as possible after sterilization . . . ____

35. Storage

Dehydrated media bottles kept tightly closed and stored at less than 30°C. . . . . ____

Dehydrated media not used if discolored or caked . . . . ____

Sterile culture media stored in clean area free from contamination and excessive evaporation . . . . ____

Sterile batches used in less than 1 week. . . . . ____

All media protected from sunlight . . . . ____

If media is stored at low temperatures, it must be incubated overnight and any tubes with air bubbles discarded . . . . ____

Culture Media - Specifications

36. Lactose Broth

Manufacturer ____________________ Lot No. ____________

Single strength composition 13 g per liter distilled water 0

Single strength pH 6.9 ± 0.1, double strength pH 6.7 ± 0.1 . . . . . . ____

Not less than 10 ml medium per tube . . . . ____

Composition of medium after 10 ml sample is added must contain 0.013 g per ml dry ingredients. . . . . ____

37. Lauryl Tryptose Broth

Manufacturer Difco Lot No. 571664

Single strength composition 35.6 g per liter distilled water . . . . . . ____

Single strength pH 6.8 ± 0.1, double strength pH 6.7 ± 0.1 . . . . . . ____

Not less than 10 ml medium per tube . . . . ____

Composition of medium after 10 ml sample is added must contain 0.0356 g per ml of dry ingredients . . . . ____

38. Brilliant Green Lactose Bile Broth

Manufacturer Difco Lot No. 552716

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38. Brilliant Green Lactose Bile Broth (Continued)
   Correct composition, sterility and pH 7.2. . . . . ____
   Not less than 10 ml medium per tube . . . . ____

39. Eosin Methylene Blue Agar
   Manufacturer ____________ Lot No. ____________
   Medium contains no sucrose, Cat. No. ____________
   Correct composition, sterility and pH 7.1. . . . . ____

40. Plate Count Agar (Tryptose Glucose Yeast Agar)
   Manufacturer ____________ Lot No. ____________
   Correct composition, sterility and pH 7.0 ± 0.1 . . . . ____
   Free from precipitate. . . . . ____
   Sterile medium not remelted a second time after sterilization. . . . . . ____

41. EC Medium
   Manufacturer Difco Lot No. 544700
   Correct composition, sterility and pH 6.9. . . . . ____
   Not less than 10 ml medium per tube . . . . ____

42. M-Endo Medium
   Manufacturer Difco Lot No. 547223
   Correct composition and pH 7.1 - 7.3 . . . . ____
   Reconstituted in distilled water containing 2% ethanol. . . . . ____
   Heat to boiling point, promptly remove and cool . . . . ____
   Store in dark at 2 - 10°C . . . . ____
   Unused medium discarded after 96 hrs . . . . ____

43. M-FC Broth
   Manufacturer ____________ Lot No. ____________
   Correct composition and pH 7.4 . . . . U
   Reconstituted in 100 ml distilled water containing 1 ml of a 1% rosolic acid reagent. . . . . ____
   Stock solution of rosolic acid discarded after 2 weeks or when red color changes to muddy brown . . . . ____
   Heat to boiling point, promptly remove and cool . . . . ____
   Store in dark at 2 - 10°C . . . . ____
   Unused medium discarded after 96 hrs . . . . ____

44. ____________ Broth
   Manufacturer ____________ Lot No. ____________
   Correct composition and pH . . . . ____

45. ____________ Agar
   Manufacturer ____________ Lot No. ____________

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45. ______________ Agar (Continued)
Correct composition and pH. . . . . ____

Multiple Tube Coliform Test

46. Presumptive Procedure
Lactose broth ______________ lauryl tryptose broth **Difco**
Shake sample vigorously . . . . ____
Potable water: 5 standard portions, either 10 or 100 ml. . . . . ____
Stream monitoring: multiple dilutions . . . . ____
Incubate tubes at 35° ± 0.5°C for 24 ± 2 hr . . . . ____
Examine for gas **Yes** any gas bubble positive. . . . . ____
Return negative tubes to incubator. . . . . ____
Examine for gas at 48 ± 3 hr from original incubation . . . . ____

47. Confirmed Test
Promptly submit all presumptive tubes showing gas production before or at 24 hr and 48 hr periods to Confirmed Test . . . . ____

a. Brilliant green lactose broth
Gently shake presumptive tube or mix by rotating . . . . ____
Transfer one loopful of positive broth or one dip of applicator from presumptive tube to brilliant green lactose broth. . . . . ____
Incubate at 35° ± 0.5°C and check at 24 hrs for gas production. . . ____
Reincubate negative tubes for additional 24 hrs and check for gas production . . . . ____
Calculate MPN or report positive tube results. . . . . ____

b. Endo or eosin methylene blue agar plates adequate streaking to obtain discrete colonies separated by 0.5 cm. . . . . ____
Incubate at 35° ± 0.5°C [illegible] 24 ± 2 hr . . . . ____
Typical nucleated col[illegible] with or without sheen are coliforms . . ____
If atypical unnucleated pink colonies develop, result is doubtful and completed test must be applied. . . . . ____
If no colonies or only colorless colonies appear, the confirmed test is negative. ____

48. Completed Test
Applied to all potable water samples or a proportion each three months to establish the validity of the confirmed test in determining their sanitary quality. X
Applied to positive confirmed tubes or to doubtful colonies on differential medium. . . . . ____
Streak positive confirmed tubes on Endo or EMB plates for colony isolation. . . . . ____

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48. Completed Test (Continued)

Choice of selected isolated colony for verification should be one typical or two atypical to lactose or lauryl tryptose broth and to agar slant for Gram stain. . . . . ____

Incubate at 35°C ± 0.5°C for 24 hrs or 48 hrs . . . . ____

Gram negative rods without spores and gas in lactose tube with 48 hrs in positive Completed Test . . . . ____

Membrane Filter Coliform Test

49. Application as Standard Test

Use as a standard test for determining potability of water after demonstration by parallel testing that it yields information equal to that from the multiple-tube fermentation procedure . . . . ____

50. MF Procedure

Filter funnel and receptacle sterile at start of series. . . . . ____

Rapid funnel resterilization by UV, flowing steam or boiling water acceptable. . . . . ____

Membrane filter cultures and technician eyes should not be subject to UV radiation leaks. . . . . ____

Filtration volume not less than 100 ml for potable water; multiple dilutions for stream pollution . . . . ____

Rinse funnel by flushing several 20 - 30 ml portions of sterile buffered water through MF X

Remove filter with sterile forceps . . . . ____

Roll filter over M-ENDO medium pad or agar so air bubbles will not form . . . . ____

51. Incubation

In high humidity or in tight fitting culture dishes X

At 35°C ± 0.5°C for 22 - 24 hrs . . . . ____

52. Counting

All colonies with a metallic yellowish green surface sheen . . . . . . ____

If coliforms are found in potable samples, verify by transfers to lactose broth, then to BGB broth for evidence of gas production at 35°C within 48 hr limit. . . . . ____

Calculate direct count in coliform density per 100 ml. . . . . ____

53. Standard MF test with Enrichment

Incubate MF after filtration on pad saturated with lauryl tryptose broth for 1 1/2 - 2 hr at 35°C ± 0.5°C . . . . U

53. Standard MF test with Enrichment (Continued)

Transfer MF culture to M-Endo medium for a final 20 - 22 hr incubation at 35°C ± 0.5°C. . . . . ____

Count sheen colonies, verify if necessary, and calculate direct count in coliform density per 100 ml . . . . ____

Supplementary Bacteriological Methods

54. Standard Plate Count

Plate not more than 1 or less than 0.1 ml (sample or dilution) . . . . . ____

Add 10 ml or more liquefied agar medium at a temperature between 43 - 45°C . . . . ____

Melted medium stored for no more than 3 hr at 43 - 45°C . . . . ____

Liquid agar and sample portion thoroughly mixed by gently rotating to spread mixture evenly . . . . ____

Count only plates with between 30 and 300 colonies, exception being 1 ml sample with less than 30 colonies . . . . ____

Record only two significant figures and calculate as "standard plate count at 35°C per 1 ml of sample". . . . . ____

55. Fecal Coliform Test

a. Multiple Tube Procedure

Applied as an EC broth confirmation of all positive presumptive tubes. . . . . ____

Place EC tubes in water bath within 30 min of transfers . . . . . . ____

Incubate at 44.5°C ± 0.2°C for 24 hrs . . . . ____

Gas production is positive test for fecal coliforms. . . . . ____

Calculate MPN based on combination of positive EC tubes . . . . . ____

b. Membrane Filter Procedure

Following filtration place MF over pad saturated with M-FC broth . . . . U

Place MF cultures in water-proof plastic bag and submerge in water bath within 30 min. ____

Incubate at 44.5°C ± 0.2°C for 24 hrs . . . . ____

All blue colonies are fecal coliforms. . . . . ____

Calculate direct count in density per 100 ml . . . . ____

56. Delayed-Incubation Coliform Test

After filtration, place MF over pad of M-Endo containing 3.2 ml of a 12% sodium benzoate solution per 100 ml of medium . . . . U

Addition of 50 mg cycloheximide per 100 ml of preservative medium for fungus suppression is optional . . . . ____

Transport culture by mail service to laboratory within 72 hours . . . . ____

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56. Delayed-Incubation Coliform Test (Continued)

Transfer MF cultures to standard M-Endo medium at laboratory. . . . . ____

Incubate at 35°C ± 0.5°C for 20 - 22 hr . . . . ____

If at time of transfer, growth is visible, hold in refrigerator till end of work day then incubate at 35° overnight (16 - 18 hr period) . . . . ____

Count sheen colonies, verify if necessary, and calculate direct count in coliform density per 100 ml . . . . ____

57. Additional Test Capabilities

Fecal streptococci ____ Method ____

Pseudomonas aeruginosa ____ Method ____

Staphylococcus ____ Method ____

Salmonellae ____ Method ____

Biochemical tests ____ Purpose ____

Serological tests ____ Purpose ____

Other ____ Purpose ____

Laboratory Staff and Facilities

58. Personnel

Adequately trained or supervised for bacteriological examination of water . . . . ____

Laboratory staff 6 (Total) Prep room staff 3 (Total)

59. Reference Material

Copy of the current edition of Standard Methods available in the laboratory. . . . . ____

State or federal manuals on bacteriological procedures for water available for staff use. . . . . ____

60. Physical Facilities

Bench-top area adequate for periods of peak work in processing samples. . . . . ____

Sufficient cabinet space for media and chemical storage. . . . . ____

Office space and equipment available for processing water examination reports and mailing sample bottles . . . . ____

Facilities clean, with adequate lighting, ventilation and reasonably free from dust and drafts . . . . ____

61. Laboratory Safety

Proper receptacles for contaminated glassware and pipettes. . . . . . . ____

Laboratory Ga. Dept. of Natural Resources, EP Division
Water Supply Section Lab.

Location 47 Trinity Ave. SW
Atlanta, Georgia 30334

Date 9/12-13/72

61. Laboratory Safety (Continued)

Adequately functioning autoclaves with periodic inspection and maintenance. . . . . ____
Accessible facilities for hand washing . . . . ____
Proper maintenance of electrical equipment to prevent fire and electrical shock . . . . ____
Convenient gas and electric outlets. . . . . ____
First aid supplies available and not out-dated . . . . ____

62. Remarks

APPENDIX F

Report of a Survey of the
Georgia Department of Natural Resources
Environmental Protection Division Laboratory
47 Trinity Ave., S.W.
Atlanta, Georgia 30334

by

Earl F. McFarren
Research Chemist
Water Supply Program Support Activities
Water Supply Research Laboratory

The water chemistry laboratory of the Environmental Protection Division, Georgia Department of Natural Resources was visited on October 12th and 13th, 1972. The equipment and procedures employed in the chemical analysis of water by this laboratory conforms with the provisions of Standard Methods for the Examination of Water and Wastewater (13th edition) and the provisions of the Public Health Drinking Water Standards, except for the items marked with a cross "X" (deviation from standard) or an "O" (not being done routinely at present). Items marked with a "U" could not be determined at the time of the survey (see attached survey form).

Substances Determined

The laboratory routinely analyzes all new supplies and all municipal water supplies at least annually for alkalinity, hardness, fluoride, pH, iron, manganese, carbon dioxide and usually copper. However, only four of these substances are required by the drinking water standards, thus there are twenty-one substances in the standards for which they seldom, if ever, analyze.

Non-standard methods are being used for the determination of turbidity, chlorides, nitrates, sulfates, and surfactants (items 1a, 2c, 2f, and 2g of survey form) when done, and color, odor, cyanide, CCE, total dissolved solids, arsenic, barium, cadmium, chromium, lead, selenium, silver, mercury, and zinc are seldom done.

The laboratory does not have any equipment or personnel to carry out radiochemical determinations as these capabilities (items 4a & d) were retained in the former Radiological Health Program which is now a part of the Department of Administrative Services. This Department is doing no water surveillance and does not seem interested.

The laboratory also has the instrumentation, but not the personnel, to run pesticides, and none are being done at present on finished waters, (items 5a through 1).

Laboratory Apparatus

In general, the laboratories are well equipped. It is recommended, however, that they either use the Hach Model 2100 turbidimeter available in the

Water Quality Laboratory or else purchase another for the Water Supply Laboratory. Another atomic absorption spectrophotometer is also needed in order to be able to carry out all of the recommended metal analyses, and equipment should be obtained to determine arsenic and selenium by the new high sensitivity A.A. method (item 8a). As soon as more space and a hood can be made available, it is also recommended that the new mini-samplers and extraction equipment be purchased so that organic contaminants (CCE and CAE, item 19) can also be determined.

An effort should be made to arrange for the transfer of the internal proportional counter (which apparently is not being used) from the former Radiological Health Program to the Water Supply Laboratory or else new equipment should be purchased (item 29a).

Sampling

The Water Supply Laboratory is using only the 250 ml polypropylene sample bottle (same bottle and sample as collected for bacteriological analysis) for chemical analyses. This sample has sodium thiosulfate added as a dechlorinating agent which may interfere with some chemical determinations and is inadequate as a chemical preservative.

The 1/2 gallon plastic (disposable) milk bottles being used by the Water Quality Laboratory are adequate but samples for metal analysis should have acid added (item 32a), and samples for nitrates and surfactants should either be refrigerated or preserved with mercuric chloride (item 32b). Likewise, samples for cyanide analysis should be preserved with sodium hydroxide (item 32c) at the time of collection.

Records

The state water supply director indicated that there were 576 municipally owned systems in the state, of which 89 utilized surface water sources, and 1400 privately owned systems, all of which utilize ground water as a source. In addition, there are approximately 3,000 semi-public systems (schools, rest areas, trailer parks and restaurants) in the state which serve a population greater than one hundred.

There are on file (by individual supply) records to indicate when each supply was last analyzed and for what, however, no one has apparently attempted to compile or summarize these. Hence, it could not be determined when each supply was last analyzed, how often it was analyzed or for what (item 35).

According to laboratory records, there were 1408 samples analyzed last year for the previously discussed routine chemistries. However, about one-third of these were of private supplies done at the request of local sanitarians. Thus only about 950 public water supplies were analyzed.

If each of the ground water supplies ($1400 + 487 = 1889$) were analyzed just once every three years ($1889 \div 3 = 629$) and each of the surface water supplie were analyzed twice a year ($89 \times 2 = 178$) presumably, only 807 ($629 + 178$) samples would have had to been analyzed. However, this would have allowed for the analysi of only 150 of the 3000 semi-public supplies and for no distribution sample analysis. Thus, it would appear that an insufficient number of samples were collected (item 37).

Laboratory

The Environmental Protection Division Laboratory is divided into (physically) and composed of three separate laboratories. A Water Supply Laboratory (1 chemist), and Air Quality Laboratory (2 chemists, and 2 technicians), and a Water Quality Laboratory (streams, sewage, ground water quality) staffed with 4 chemists. Needless to say, many of the Water Supply Laboratory and the Water Quality Laboratory activities overlap and hence, could and should be integrated. At present, neither is doing any appreciable metal, pesticide or radiochemical analysis, and more space is needed. In particular, more hood space and bench top space for atomic absorption spectrophotometry, and for radiochemical analysis. One immediate solution to the space problem for the chemists would be to move the bacteriologists out of the area being used by the water supply laboratory for atomic absorption spectrophotometry. The water supply laboratory could then accommodate about 3 more people. The question seems to be where do you put the bacteriologists?

Quality Control

The Laboratory has a 20 gallon per hour Barnstead still which is preceded by a carbon absorption column to keep organics out of the distilled water. Mixed bed deionizers are also available in the laboratory for special work, such as deionization of the distilled water for preparing metal standards.

Control or standard samples are of necessity run on all samples analyzed by the auto-analyzer but not necessarily for other determinations. The laboratory has regularly participated, however, in the Geological Survey and EPA reference programs.

If this laboratory desires to be certified for the chemistries they are now or may in the future do, it will be necessary for them to analyze reference samples which we can supply or else provide us with copies of the results obtained on analysis of the EPA, Analytical Quality Control Laboratory Reference Samples.

Staff

The present staff is inadequate. At least one additional chemist is needed to undertake the recommended additional metal analysis, another full time for pesticide analysis, and another for radiochemical analysis. A fourth person (clerk) is needed for record keeping; namely, the logging in of samples, keeping track of them and recording the results of the analyses on laboratory report forms.

Conclusions

New supplies and all municipal supplies are analyzed routinely for eight substances. However, only four of these are required by the drinking water standards, and twenty-one substances in the standards are seldom if ever determined.

There are approximately 1976 community water supplies (576 municipally owned and 1400 privately owned) in the state. Eighty-nine of the municipally owned supplies are from surface water supplies. All of the rest (both municipal and privately owned) are from ground waters. In addition, there are approximately

3000 semi-public supplies in the state. According to laboratory records 1408 samples were analyzed for routine chemistries last year. However, about 450 of these were of private supplies. Therefore, only about 950 of the samples were from community supplies, and it would appear that insufficient numbers of samples were collected. Furthermore, very few distribution samples were taken.

Non-standard methods are being used (when done) for the determination of turbidity, chlorides, nitrates, surfactants, and sulfates.

Some sort of a routine sampling program should be undertaken for the determination of both pesticides and radioactivity. It is suggested that the testing begin with the surface water supplies and then progress to the ground water supplies with a goal of testing once every three to five years.

The new mini-sampler and extraction equipment should be purchased for the determination of organics (CCE and CAE) in, at least, all surface water supplies.

In order to undertake the routine analysis of all water supplies for heavy metals, it is recommended that another atomic absorption spectrophotometer be purchased so that one can be set up for such special determinations as arsenic, selenium and barium, and the other instrument left for the more conventional analyses. Mercury should be done by the Coleman analyzer, in order to avoid tying up one of the atomic absorption spectrophotometers for just this determination.

The water quality and water supply laboratory operations could in many cases (metal analysis, and chlorides, sulfates, and nitrates by auto-analyzer) be integrated into one operation. However, it will still be desirable to have a chief chemist responsible for the samples being analyzed for each section and to advise and assist with analyses peculiar to each section.

It was recommended that either an effort be made to transfer the internal proportional counter from the old Radiological Health Program to the Water Supply Laboratory or else to purchase new equipment.

An additional chemist will be needed for the pesticide analysis, another for the radiochemical analysis and another for the additional metal analysis. A clerk is also needed for logging in, keeping track of sample analyses and for recording data on a laboratory report form.

If the recommended additional chemistries are undertaken, more hood and bench space will be needed. If the bacteriology section could be moved out of the area now also being used to house the atomic absorption spectrophotometer, two or three more chemists could then occupy the present water supply laboratory.

Samples for metal analysis should be preserved at the time of collection with acid, and samples for phosphates, nitrates or surfactants should be preserved with mercuric chloride (sulfuric acid will hydrolyze the phosphates) or else refrigerated until analyzed. Likewise, all samples for cyanide analysis should be preserved with sodium hydroxide.

A compilation of the data available on each water supply is needed so that it can readily be determined how often each supply has been analyzed, for what it was analyzed, and when last analyzed.

Earl F. McFarren

Earl F. McFarren, Chief
Water Supply Program Support Activities
Water Supply Research Laboratory

SURVEY OF WATER CHEMISTRY LABORATORIES

ENVIRONMENTAL PROTECTION AGENCY
Office of Water Programs
Water Hygiene Division

Indicating conformity with the 13th edition of Standard Methods for the Examination of Water and Wastewater (1971).

Survey by Earl F. McFarren
Date October 12 & 13, 1972

X = Deviation U = Undetermined
O = Not Used

Laboratory Environmental Prot. Division
Street 47 Trinity Ave. S.W.
City Atlanta State Georgia 30334

Director Otis Wood
Chief Chemist Bob Robinson
Water Supply Chief Robert Byers

Substances Determined

1. Physical determinations

	Method	
a. color	Hellige color comparator	0
b. odor		0
c. turbidity	Hach DR-A1890	X

2. Miscellaneous anions, organics and solids

a. chlorides	occasionally, mercuric nitrate - Hach	X
b. cyanide	pyridine - pyrazalone with distillation	0
c. carbon chloroform extract		0
d. fluorides	Auto-analyzer, SPADNS	
e. nitrates	occasionally, Hach (cadmium reduction)	X
f. sulfates	occasionally, turbidimetric, Hach	X
g. surfactants	occasionally, methyl green, Hach	X
h. total dissolved solids	occasionally, aluminum dishes, 105°C	0
i. other	Alkalinity, hardness, CO_2, pH	

3. Metals

a. arsenic	delvis cup, burner at 90° using air-acetylene	0
b. barium	atomic absorption - nitrous oxide	0
c. cadmium	delvis cup, atomic absorption	0
d. chromium	atomic absorption	0
e. copper	atomic absorption	
f. iron	atomic absorption	
g. lead	delvis cup, atomic absorption	0
h. manganese	atomic absorption	
i. selenium	never done	0
j. silver	never done	0
k. mercury	Coleman flameless	0
l. zinc	atomic absorption	0
m. other		

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4. Radioactivity		
a. gross beta		0
b.. radium 226		
c. strontium 90		
d. other	gross alpha	0
5. Pesticides		
a. aldrin		0
b. chlordane		0
c. dieldrin		0
d. DDT	HAVE CAPABILITIES BUT	0
e. endrin	NEVER DONE ON MUNICIPAL	0
f. heptachlor	SUPPLIES	0
g. heptachlor epoxide		0
h. methoxychlor		0
i. lindane		0
j. toxaphene		0
k. total organic phosphates plus carbamates		0
l. chlorinated phenoxy alkyl pesticides		0
m. other		

Laboratory Apparatus

	Make	Model	
6. Color comparators			
a. visual	Hellige		
b. filter photometer	Hach DR-A	1890	
7. Spectrophotometer			
a. visible	DU-2, Spectronic 20 (2)		
b. flame			
c. other			
8. Atomic absorption spectrophotometer			
a. air-acetylene burner	Perkin-Elmer	303	
b. nitrous-oxide burner	"	303	
c. argon-hydrogen flame			0
d. cold-vapor (flameless)	Coleman		
9. Gas chromatographic equipment			
a. electron capture	Nickel 63	Tracor MT-220	
b. flame photometric		Tracor	
c. microcoulometric			
d. other	Coulson - Conductometric flame ionization		

Laboratory	Location	Date
Environmental Protection Division	Atlanta Georgia 30334	10/12-13/72

	Make	Model	
10. Other chromatographic equipment			
a. thin-layer			
b. Kuderna-Danish evaporator		have	
c. other			
11. Turbidimeter	Hach (Water Quality)	2100	
12. Amperometer			
13. Titrimeter			
14. pH meter	Orion digital	Model 701	
15. Fluoride electrode			
16. Arsine generator	have		
17. Cyanide still	have (Water Quality)		
18. Fluoride still			
19. Carbon-chloroform extraction equipment			
a. high or low flow columns			
b. carbon drying oven			
c. extraction apparatus			
d. manifold for solvent evaporation			
20. Drying oven		Blue Line M	
21. Steam bath	have		
22. Hot water bath	have		
23. Muffle furnace	Heavy Duty		
24. Distilled water still	Barnstead 20 gal/hr.		
25. Water deionizer	mixed bed		
26. Conductivity meter	Precision		
27. Balance, sensitive to 0.1 mg	Mettler (3)		
28. Automatic analyzer for			
a. nitrates plus nitrites	have (Water Quality)		
b. nitrites			

	Make	Model	
28. Automatic analyzer for (Continued)			
c. chloride			
d. sulfate			
e. cyanide			
f. fluoride	have		
g. other	ammonia		
29. Radiation Counting Equipment			
a. internal proportional counter	Nuclear-Chicago	Ultra Scale II	0
b. alpha-scintillation counter			
c. other	Gamma Scintillation Counter		
30. Other Instruments or Equipment			
a.			
b.			
c.			
d.			

Sampling

31. Containers

a. Non-reusable plastic containers preferred for the collection of samples for general inorganic analysis. . . . . ____

b. Glass bottles with teflon lines caps preferred for collection of pesticide samples . . . . ____

c. Other kind . . . . 250 ml. polypropylene . . . . ____
1/2 gal. plastic milk bottles (Water Quality)

32. Preservatives

a. Samples for metal analysis preserved by the addition of nitric acid to a pH of about 2.0 X

b. Nitrates and methylene blue active substances preserved by addition of mercuric chloride . Sulfuric.acid X

c. Cyanide preserved by the addition of sodium hydroxide to a pH of 11. X

d. No known or required preservative for turbidity, color, pH, chloride, sulfate, fluoride, specific conductance and total dissolved solids. . . . . ____

e. If no preservative is used, in general samples are analyzed within 72 hrs . . . . ____

Laboratory	Location	Date
Environmental Protection Division	Atlanta, Georgia 30334	10/12-13/72

33. Identification
   a. Every bottle should be identified by attaching an appropriately inscribed tag, a label or a number corresponding to a sample identification sheet. . . . . _____
   b. The minimum information required on the tag or correspondingly numbered sheet includes; name of the water supply sampled, location of sampling site, exact date and time of collection, type of sample (raw, finished, grab or composite; by whom collected, and kind of preservative if added . . . . _____

34. Collection
   a. Samples from wells collected after pumping for a sufficient time to assure that the sample is representative of the ground water which feeds the well. . . . . U
   b. Finished (treated) water sampled at the plant by use of a pipeline drip device or the collecting and compositing of hourly (or other interval) samples . . . . . U
   c. Distribution samples obtained at several different points in the system; usually grab samples obtained without first flushing the line, although both kinds of samples may at times be desirable. . . . . U

Records

35. Availability
   a. Assay results assembled and available for inspection X
   b. Notation made of those water supplies which did not comply with one or more standards, and some sort of follow-up program instigated . . . . _____

36. Number analyzed annually
   a. private supplies about 450
   b. semi-public _____
   c. municipal about 950
      (1) sources _____
      (2) finished _____
      (3) distribution _____

37. Frequency

a. Physical characteristics measured at least once a week and preferably every day at the treatment plant. . . . . ______

b. Chemical characteristics determined at least once every three years on ground water supplies and semi-annually on surface water supplies unless previous data has indicated a potential problem which needs to be monitored more frequently __X__

Laboratory

38. Physical facilities

a. Bench top area adequate . . . . __X__

b. Sufficient cabinet space for chemicals and glassware . . . . ______

c. Adequate hood space. . . . . __X__

d. Office space available for record keeping and processing reports . . . . ______

e. Space for storage and handling of bottles. . . . . ______

39. Glassware

a. Thoroughly washed with suitable detergent and warm water . . . . ______

b. Rinsed immediately in clean tap water to remove detergent . . . ______

c. Final rinse with distilled water. . . . . ______

d. Dichromate cleaning solution used for difficult to clean glassware. . . . . ______

e. Glassware used for pesticide analysis should receive a final rinse with A. R. grade acetone or ethyl acetate . . . . . . ______

40. Organization

a. Total number of laboratories examining water ___1___ . . . . ______

b. Water laboratory is a separate unit, and not part of a food, drug, or toxicological laboratory . . . . ______

c. Each of the other regional laboratories have the same capabilities. . . . . ______

d. Radiation chemistry is a part of the water laboratory . . . . . . __X__

Quality Control

41. Laboratory water quality

a. Conductivity of water checked at regular intervals . . . . ______

b. Use of deionized water for metal analysis . . . . ______

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Laboratory	Location	Date
Environmental Protection Division	Atlanta, Georgia 30334	10/12-13/72

42. Control Samples
   a. A control sample of known composition (in addition to any necessary standards) is analyzed every time one or more unknown samples are analyzed. 0
   b. A control sample is available and used for each substance specified in the drinking water standards 0
   c. A control chart has been constructed for each substance, and the precision of each determination has been calculated 0

43. Reference Samples
   a. Accuracy and ability of laboratory to perform each analysis checked by requiring them to analyze an unknown reference sample(s) supplied by the surveying office or laboratory at least once a year . . . . ____

Staff

44. Personnel
   a. Total number of staff 1 . . . . ____
   b. Number with degrees in chemistry 1 . . . . ____
   c. Does state operate under a merit system. . . . . ____
   d. Are job descriptions written . . . . ____
   e. Does state encourage attendance at professional meetings, short courses, etc. . . . . ____

45. Salaries
   a. Chief chemist 15 to $16,000 . . . . ____
   b. Assistant chemist 9 to $10,000 . . . . ____
   c. Aids $6,000 . . . . ____

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APPENDIX G

WATERBORNE DISEASE OCCURRENCE

Since the middle of the nineteenth century, when Dr. John Snow did his classical study on the transmission of cholera through a water supply, it has been generally recognized that disease epidemics can, and do, result from consumption of water containing pathogenic microorganisms. Diseases most commonly associated with drinking water are typhoid fever, dysentery, gastroenteritis, and infectious hepatitis. Spread of these diseases occurs most commonly when body wastes from the infected persons are ingested. While person-to-person contact is recognized as the most probable method of transmission for low incidence levels currently found in this country, the potential for catastrophic epidemics transmitted by drinking water supplies serving thousands of people remains.

In recent years, concern has also been directed to the possible chronic diseases which may result from use of water containing certain chemicals. These potentially dangerous chemicals include heavy metals, pesticides, and other toxic industrial products. Although few clinical cases are recorded, health agency statistics are usually limited to communicable diseases and affected individuals may have unrecognized symptoms. With increased reuse of water by municipal, agricultural, and industrial users, the potential for chemical contamination must be recognized. During the 25-year period 1946-1970, there were 356 known waterborne disease outbreaks in this country. At present, waterborne outbreaks occur at a rate of over one per month, and average 1,600 illnesses and one death per year. Recent national attention was focused on waterborne illness when almost 200 residents of a migrant labor camp in an adjoining state contracted typhoid fever through contaminated shallow wells. This was the largest waterborne typhoid epidemic in over 30 years.

Only one Georgia outbreak has been fully documented since 1960. At least 44 persons contracted gastroenteritis and shigellosis in the summer of 1968 at a YMCA Camp near Waco. Investigation implicated a septic tank as possibly contaminating wells. No fatalities resulted.

While epidemiological records do not generally show widespread incidence of waterborne disease, this may actually reflect incomplete reporting, inaccurate diagnosis, and the fact that much enteric illness is not treated by physicians. Some authorities have suggested that cases of such diseases as gastroenteritis and infectious hepatitis may actually be as many as 100 times the number reported.

Table I presents a tabulation of significant potentially waterborne diseases and a comparison of the number of cases occurring in Georgia versus the number occurring nationwide for the past ten years. While Georgia has approximately 2.3 percent of the nation's population, it has:

(1) 0.4 percent of the total number of reported cases of amebiasis for the period 1961-1970.

(2) 1.7 percent of the total number of reported cases of viral hepatitis for the period 1961-1970.

(3) 4.7 percent of the total number of reported cases of shigellosis for the period 1961-1970.

(4) 2.8 percent of the total number of reported cases of typhoid fever for the period 1961-1970.

(5) 3.5 percent of the total number of reported cases of salmonellosis for the period 1961-1970.

The data in the Table are not intended to imply that all reported cases were waterborne. A portion of these cases, however, plus an unknown number of unreported cases may have been waterborne. In addition, body wastes from these diseased persons pose the constant threat of contaminating drinking water with pathogenic microorganisms.

In essentially all documented cases of waterborne illness, it has been shown that definite deficiencies existed in the water supply systems during the time when disease was transmitted. Furthermore, these deficiencies were either unrecognized because of inadequate surveillance, or were recognized but not remedied. Deficiencies similar to those believed responsible for epidemics still are found in the water supplies of Georgia. The requisites are present in Georgia for repetition of the tragic epidemics of the past, namely deficient health protection of public water supplies and presence of diseased individuals. Greater vigilance by public officials and the water supply industry is indicated in order to minimize risk from drinking water supplies.

TABLE I

INCIDENCE OF WATER-BORNE DISEASE

Year	Amebiasis	Hepatitis	Salmonellosis	Shigellosis	Typhoid
1962					
Reported Ga. Cases	7	272	357	499	21
Reported U. S. Cases	3048	53,016	9680	12,443	608
Percent in Ga.	.23	.51	3.5	4.0	3.3
1963					
Reported Ga. Cases	2	177	481	459	14
Reported U. S. Cases	2886	42,974	15,390	13,009	566
Percent in Ga.	.70	.40	3.1	3.5	2.4
1964					
Reported Ga. Cases	2	127	589	624	27
Reported U. S. Cases	3304	37,740	17,144	12,984	501
Percent in Ga.	.60	.33	3.4	4.8	5.3
1965					
Reported Ga. Cases	2	166	822	672	14
Reported U. S. Cases	2768	33,856	17,161	11,027	454
Percent in Ga.	.72	.50	4.8	6.1	3.1
1966					
Reported Ga. Cases	6	530	605	663	4
Reported U. S. Cases	2921	32,859	16,841	11,888	378
Percent in Ga.	.20	1.6	3.5	5.6	1.0
1967					
Reported Ga. Cases	4	916	499	791	15
Reported U. S. Cases	3157	38,909	18,120	13,474	396
Percent in Ga.	.12	2.3	2.7	5.3	3.8
1968					
Reported Ga. Cases	4	1016	690	673	14
Reported U. S. Cases	3005	45,893	16,514	12,180	395
Percent in Ga.	.13	2.2	4.1	5.5	3.6
1969					
Reported Ga. Cases	2	807	799	576	15
Reported U. S. Cases	2915	48,416	18,419	11,946	364
Percent in Ga.	.70	1.6	4.3	4.8	4.1
1970					
Reported Ga. Cases	3	727	930	659	4
Reported U. S. Cases	2888	56,797	22,096	13,845	346
Percent in Ga.	.10	1.2	4.2	4.7	1.1
1971					
Reported Ga. Cases	2	378	492	509	4
Reported U. S. Cases	2752	59,606	21,928	16,143	407
Percent in Ga.	.73	6.3	2.2	3.1	1.0
Totals 1962-71					
Reported Ga. Cases	34	5,116	6,264	6,125	132
Reported U. S. Cases	29,644	450,066	173,293	128,939	4,415
Percent in Ga.	.42	1.7	3.5	4.7	2.8